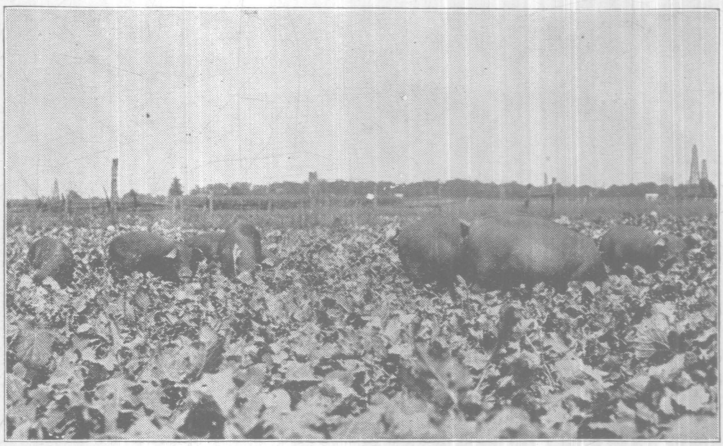
THE USE OF FORAGE CROPS IN THE FATTENING OF PIGS

OHIO

Agricultural Experiment Station

WOOSTER, OHIO. U. S. A., JUNE, 1920

BULLETIN 343



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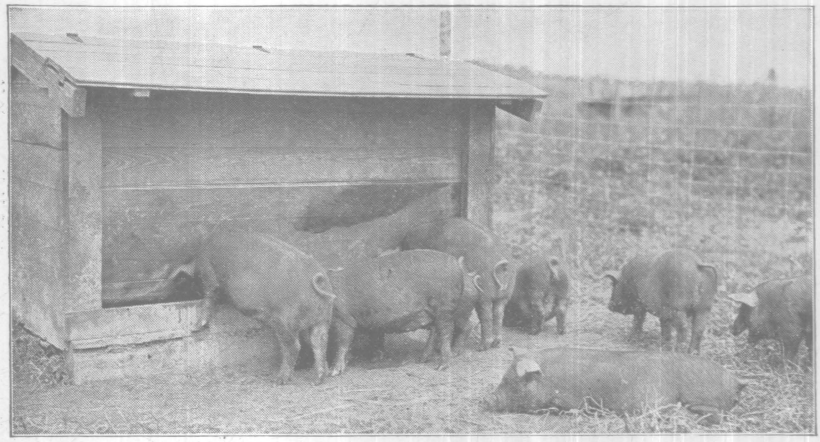


Self feeder in use. Pigs of Lot 2, Experiment I, shortly after the beginning of the test

BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 343 JUNE, 1920

THE USE OF FORAGE CROPS IN THE FATTENING OF PIGS

W. L. ROBISON*

The experiments here reported were conducted to secure a larger fund of information concerning the influence of the kind of forage, of the method of feeding and of the character and amount of the concentrates fed in connection with forage on the economy of production. Comparisons (1) of full and limited rations of concentrates with and without a nitrogenous supplement, (2) of self and hand feeding and (3) of different crops and forage crop combinations were made. The work is presented with the view of enabling the farmer to determine with some degree of accuracy the methods which under given conditions will bring returns approaching the maximum from both the pigs and the land used in growing the forage.

Pigs used.—Except when otherwise mentioned purebred Duroc Jersey pigs raised at the Ohio Experiment Station from related dams were used in the experiments. Spring pigs farrowed in March and April were used in all the tests. In selecting the pigs care was taken to make the lots for an experiment as nearly uniform as possible in regard to breeding, sex, age, weight, thrift and previous treatment.

Weighing.—During the experiments individual weekly weights were taken. The weighing was done just after noon each time and care was taken to see that conditions were normal. Since for the purpose of selecting pigs for the various lots, the pigs were usually weighed the day previous to the beginning of an experiment a check on the initial weights was secured.

Shelter and water supply.—The pigs on forage had no shelter other than shades of boards supported on posts. If the weather

*Tests made during or preceding 1915 were planned and conducted by Geo R Eastwood, who was then in charge of the swine work

became too cold before the close of an experiment two or three sides were closed up or movable houses were provided. The pigs in dry lot were kept in pens of a large central house and given the run of small outside pens containing no green feed. An abundance of water in open troughs was provided at all times.

Plan of feeding.—All experiments began with the evening feed on the first day and closed with the morning feed on the last day of the test. The rations were determined by weight. When limited rations based on the weight of the pigs were fed the daily feed for each week was determined from an estimate of what the pigs would weigh by the middle of the week.

Terms used.—The term "concentrates" includes the corn or other grains or mill feeds used and the supplement such as tankage fed with these. Pigs which received practically all the concentrates they would clean up readily twice daily regardless of whether they were in a dry lot or on forage are designated as "full-fed" pigs. Rations designated as 1, 2 and 3 percent feeds refer to pounds of concentrates fed daily for each 100 pounds of live weight.

Methods used in calculations.—When a pig was taken out of a lot the total feed and total gain until then were determined and from thence the gain and feed were calculated on the basis of a full number of pigs per lot. During the first part of an experiment pigs require less feed per unit of gain and gain more slowly than they do later when older and heavier.

The concentrates replaced by an acre of pasture may be determined either by multiplying the amounts of feed replaced (as compared with dry lot feeding) for each 100 pounds of gain by the hundredweight of gain produced per acre, or by finding the difference in the amounts fed in connection with each acre of forage and the amounts that would have been required to produce an equal gain in dry lot. The data given in the tables compare pigs self-fed on forage with self-fed pigs in dry lot and those hand-fed on forage with those hand-fed in dry lot. The fairly efficient ration of corn alone on forage, however, was compared with corn and tankage feeding in dry lot rather than with corn alone in dry lot, which is a very poor ration.

The gains to be accredited to an acre of forage were determined from the corn and tankage replaced by the forage. The tankage in each case was converted to its corn equivalent, this added to the corn and the total corn equivalent then changed to the same proportions of corn and tankage as were used by the pigs in dry lot. The result divided by the feed consumed per pound of gain

by the pigs in dry lot is taken as the gain due to the forage. When the corn equivalent of a pound of tankage could not be found directly, because rations of corn alone and of corn and tankage were not both fed on forage, the replacement value of the tankage (expressed in corn) as given in Table XXIII, page 215, was used.

The value of the gains over the value of the feed and pasture for an experiment is always based on an equal number of pigs per lot.

There is no way of determining the exact proportion of the pasture utilized by the pigs for each third of the test. Consequently, for lack of a better method, when an experiment is summarized by periods the value of the pasture utilized each period as compared with the total is assumed to be the same in percentage as the gains for the period are of the total gains.

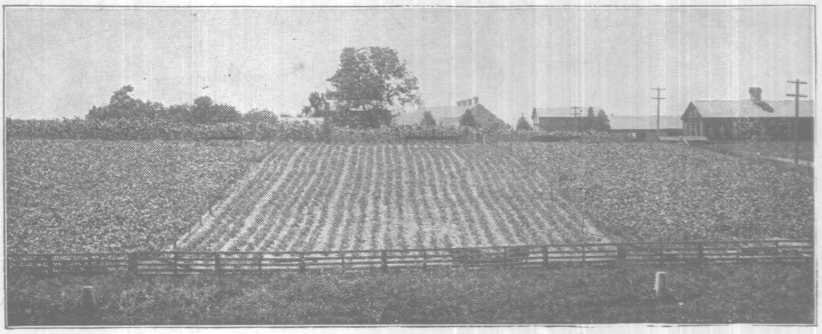
Composition of pasture crops.—For purposes of reference the percentage composition of various forage crops is given in Table I. Since the moisture content of different crops and of the same crop at different stages of growth varies considerably, in order to get an accurate conception of the relative percentage of nutrients contained, it is necessary to compare their compositions on a moisture-free basis.

TABLE I.—COMPOSITION OF GREEN FORAGE CROPS

	Height when analyzed	Water	Ash	Crude protein Nx6.25	Carbohydrates		Fat (ether extract)
					Fiber	N-free extract	
Fresh sample							
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Red clover (Kentucky Bul. 175) green	11	81.25	2.01	4.31	2.64	9.20	.59
Red clover (Feeds & Feeding) in bloom		72.50	2.00	4.10	8.20	12.10	1.10
Bluegrass (Ky. Bul. 175) before heading	7	82.52	1.72	4.66	3.90	5.88	1.32
Bluegrass (Feeds & Feeding) after blooming		56.40	4.10	3.40	13.20	21.60	1.30
White clover (Feeds & Feeding)		78.20	2.70	4.60	4.20	9.50	.80
Rape (Ohio Bul. 242)	10	87.84	1.51	2.49	2.22	5.71	.23
Alfalfa (Kentucky Bul. 175) green	8	84.35	1.93	4.71	2.87	5.59	.55
Sweet clover (Feeds & Feeding)		75.60	2.10	4.40	7.00	10.20	.70
Soybeans (Ohio Bul. 242) green	10	72.28	2.22	4.86	8.08	12.25	.31
Oats (Feeds & Feeding)		73.90	2.10	3.20	7.80	11.90	1.10
Canada field peas (Feeds & Feeding)		83.40	1.60	3.60	4.00	6.90	.50
Computed on moisture free basis							
Red clover, green			10.72	22.99	14.08	49.07	3.14
Red clover, in bloom			7.27	14.91	29.82	44.00	4.00
Bluegrass, before heading			9.84	26.66	22.31	33.64	7.55
Bluegrass, after blooming			9.40	7.80	30.28	49.54	2.98
White clover			12.38	21.10	19.27	43.58	3.67
Rape			12.42	20.48	18.26	49.95	1.89
Alfalfa, green			12.33	30.10	18.34	35.72	3.51
Sweet clover			8.61	18.03	28.69	41.80	2.87
Soybeans, green			8.01	17.53	29.15	44.19	1.12
Oats, green			8.05	12.26	29.89	45.59	4.21
Canada field peas			9.64	21.69	24.10	41.56	3.01

A suitable pasture crop for fattening pigs is succulent and palatable and contains a minimum of crude fiber and a maximum of ash and protein. As plants mature their crude fiber increases and the ash and protein decrease. This is illustrated by the two analyses of bluegrass and of red clover given in the table. Because of these changes as plants develop they become less valuable as forage for swine. In composition rape compares favorably with clover or alfalfa. It is high in protein and low in fiber. This, together with the fact that it produces new growth and remains green throughout the summer, no doubt helps to account for the good showing it makes. Bluegrass and the cereals, such as oats, rye and wheat have as high a protein content while young and green as do the legumes and at this stage of growth are equally as valuable for pasture. Later they lose their nitrogenous character and become woody and fibrous. They are then of little value for forage.

Factors such as its suitableness to local soil and climatic conditions, its ease and cheapness of seeding, the extent to which it withstands trampling and grazing, its ability to produce new growth and remain green even during the hot dry weather of late summer and either its permanency or its fitness as a crop of the common rotation affect the worth of a forage crop.



Rape pasture. Rape is an excellent annual forage crop for swine. It may be grown to supplement alfalfa or clover pasture or to take their place when these are not available

FEEDING ON CLOVER PASTURE

EXPERIMENT I

SELF AND HAND FEEDING ON CLOVER AND MIXED PASTURE

Seventy purebred Duroc-Jersey pigs, ranging from 61 to 67 days of age at the beginning of the test, were used in the experiment. Prior to this time they were on bluegrass pasture and were given a full feed of concentrates, having been placed on feed when between 3 and 4 weeks of age. They were weaned when 8 weeks old. Previous to weaning 16 of the pigs received a ration of corn, skimmilk and tankage; 27, a ration of corn, middlings and tankage and 27 a ration of corn, linseed meal and tankage. The sows were fed the same rations their pigs received. From weaning until divided all the pigs were given a ration of corn, 5 parts; middlings, 3 parts; tankage, 1 part. The experiment began May 30 and was continued until October 3, 1916, a period of 18 weeks. The ration fed, forage used, method of feeding and number of pigs in each lot are shown in Table II, which gives a summary of the results secured. Shelled corn was fed. The feed was given dry. The plots of clover and the plot of bluegrass and white clover each contained an area of one-half acre. Until August 22, or for the first 12 weeks of the test, the pigs of Lot 5 were fed three-fourths as much of concentrates as was consumed by those of Lot 3. For the remaining third (6 weeks) of the test they were given a full feed. The pigs of Lot 5 were given three-fourths as much feed throughout the test as was taken by those of Lot 3 receiving a full feed.

The forage plots were intended to furnish sufficient green feed for all the lots throughout the test, but owing to extremely dry weather during August and September failed to do this. Lots 1, 4 and 5 had very little clover after September 5 and Lot 3 only a small amount after September 19. The pigs of Lot 2 ate less clover than those of the other lots and had an abundance at all times. Since some clover was left on this plot and was utilized for other purposes after the close of the test they were charged with five-twelfths rather than one-half acre. The bluegrass for Lot 6 contained considerable white clover and was so located as to have more favorable moisture conditions than the clover plots. It remained green throughout the hot, dry weather of late summer. Lots 7 and 8 were kept in 10 by 12-foot pens in the central house and allowed the run of small (10 by 40 foot) outside pens containing no green feed.

TABLE II.—EXPERIMENT I: FATTENING PIGS ON FORAGE

May 30 to October 3, 1916

	Lot 1 Corn alone self-fed	Lot 2 Corn and tankage self-fed	Lot 3 Corn, 19; tankage, 1; hand-fed full feed	Lot 4 Corn, 19: tankage, 1; ¾ feed for ⅔ of test	Lot 5 Corn, 19; tankage, 1; ¾ feed entire time	Lot 6 Corn and tankage self-fed	Lot 7 Corn and tankage self-fed	Lot 8 Corn, 9; tankage, 1; hand-fed
Kind of forage	Clover	Clover	Clover	Clover	Clover	Bluegrass and w. clover	None	None
Number of pigs	10	10	10	10	10	10	5	5
Average initial weight, pounds	34.35	34.20	34.85	34.50	34.30	35.20	35.60	35.60
Total gain, pounds	1,008.833	1,666.5	1,615.00	1,431.5	1,269.5	1,785.00	834.5	589.167
Average daily gain, pounds	.801	1.323	1.282	1.136	1.008	1.427	1.325	.935
Concentrates consumed: corn, pounds	3,918.778	5,257.5	5,243.525	4,498.393	3,969.993	5,615.00	2,594.5	2,025.6
tankage, pounds	.....	503.8	275.975	236.757	208.947	468.00	306.00	225.067
total, pounds	3,918.778	5,761.3	5,519.5	4,735.15	4,178.94	6,083.00	2,900.5	2,250.667
Daily concentrates per pig, pounds	3.110	4.572	4.381	3.758	3.317	4.862	4.604	3.572
Concentrates daily per 100 pounds weight, pounds	3.668	3.890	3.790	3.543	3.391	3.896	3.867	3.780
Concentrates per 100 pounds gain: corn, pounds	388.447	315.482	324.676	314.243	312.721	314.566	310.905	342.807
tankage, pounds	.....	30.231	17.088	16.539	16.459	26.218	36.668	38.201
total, pounds	388.447	345.713	341.764	330.782	329.180	340.784	347.573	382.008
Cost of concentrates per 100 pounds gain, dollars	7.77	7.52	7.18	6.95	6.91	7.34	7.68	8.40
Yield in dressed weight, percent	77.474	80.657	79.038	78 413	77.396	80.136	79.852	80.336
Value of pasture utilized, dollars	12.00	10.00	12.00	12.00	12.00	12.00	.....	.....
Value of hogs per 100 pounds, dollars	13.45	14.00	13.72	13.61	13.43	13.91	13.86	13.94
Value of gains over value of feed and pasture, dollars	45.31	98.01	93.67	83.39	70.74	106.03	103.06	65.23
Concentrates replaced by an acre of pasture:								
corn, pounds	—1,564.537	—183.054	617.931	846.421	789.285	—130.701	.....	.....
tankage, pounds	739.851	257.480	681.939	620.177	552.026	373.071	.....	.....
Corn or its equivalent in cost saved by an acre of pasture, bushels	—1.50	5.927	35.389	37.264	33.808	10.990	.....	.....
Gains accredited to an acre, pounds	55.371	109.761	519.219	537.437	431.403*	191.234	.....	.....
Parts of corn to tankage consumed	.....	10.44:1	19:1	19:1	19:1	12:1	8.48:1	9:1

On September 12 an 84.5-pound pig was taken out of Lot 1; on June 13 a pig in Lot 5 that became ruptured was replaced by another 1 pound heavier; on June 4 a 29.5-pound pig of Lot 6 died; a pig 7 pounds heavier was put in its place June 13; on August 22 two pigs were taken out of Lot 8, weight 111.5 pounds.

Corn, $1.12 per bushel; tankage, $80 per ton; hogs, $14 per 100 pounds; pasture, $24 per acre.

*On the assumption that 1.792 pounds of corn were replaced by a pound of tankage.

The pigs that were self-fed corn alone on clover gained less rapidly and required more concentrates per unit of gain than any of the others. Their daily consumption of grain per unit of weight was lower than that for any of the other full-fed pigs. The pigs of Lot 2 self-fed corn and tankage ate less clover than the hand-fed pigs or those self-fed corn alone. The proportion of tankage consumed was greater than that used in the hand-fed rations and the daily consumption of concentrates per unit of weight as well as the rate of gain was higher than that for any of the other lots on clover. There was very little difference in the amount of concentrates required per unit of gain by the self-fed pigs and those hand-fed a full feed of corn and tankage.

Each decrease in the amount of concentrates fed decreased the rate of gain. The pigs fed limited rations of concentrates consumed less grain per unit of gain and ate more clover than the full-fed pigs.

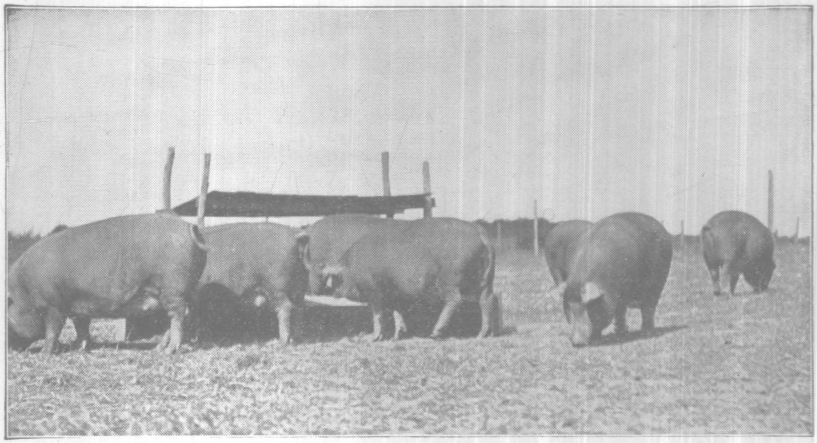
Both the higher rate of gain and the slightly lower concentrate requirement per unit of gain of the bluegrass and white clover lot, as compared with the lot similarly fed on clover, is very largely the result of the more favorable showing of the former lot for the last third of the test and is very likely explainable by the fact that the grass remained green and succulent. Chemical analyses show that both white clover and bluegrass before heading contain a higher percentage of protein than does red clover when in bloom. For the first two-thirds of the test there was very little difference in either the rate or the economy of gains. The pigs on bluegrass and white clover and those self-fed corn and tankage on clover gained at the rates of 1.16 and 1.15 pounds daily per head and per 100 pounds of gain, consumed 320.6 and 321.5 pounds of concentrates, respectively.

The results of Lot 7 demonstrate that if they can be kept in good physical condition and are given a properly balanced ration it is not necessarily true that pigs fed in dry lot will gain less rapidly or economically than others similarly fed with the exception of forage. The pigs of Lot 7, self-fed on corn and tankage in dry lot, consumed more tankage but less corn per unit of increase in live weight than those self-fed corn and tankage on clover or those self-fed corn and tankage on bluegrass and white clover.

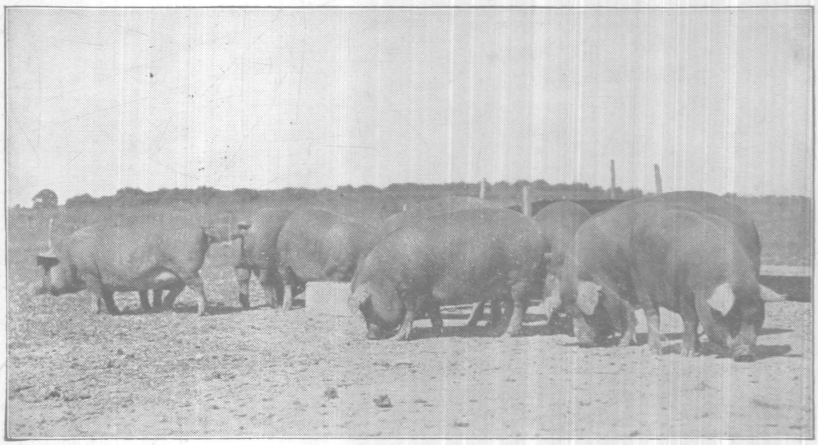
The pigs hand-fed in dry lot gained less rapidly and required more feed per unit of gain than the pigs self-fed in dry lot. In other dry lot experiments self-fed pigs have usually consumed as much or more feed for each unit of gain produced than have the hand-fed pigs with which they were compared.

Lot 1 of Experiment I, self-fed corn alone on pasture

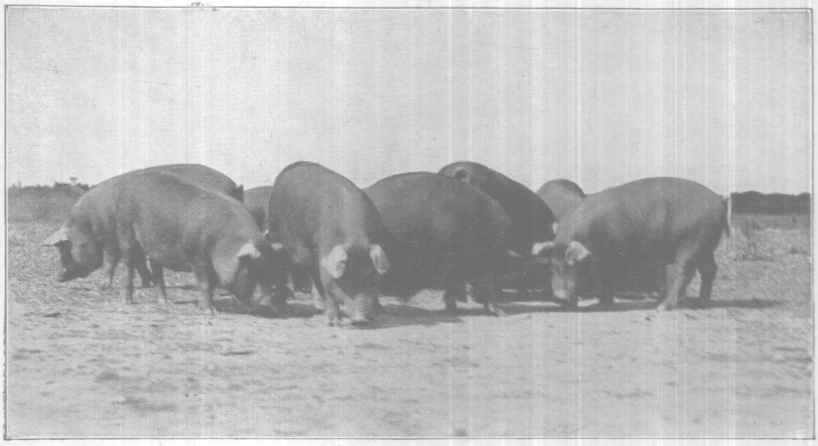
Lot 2 of Experiment I, self-fed corn and tankage on clover



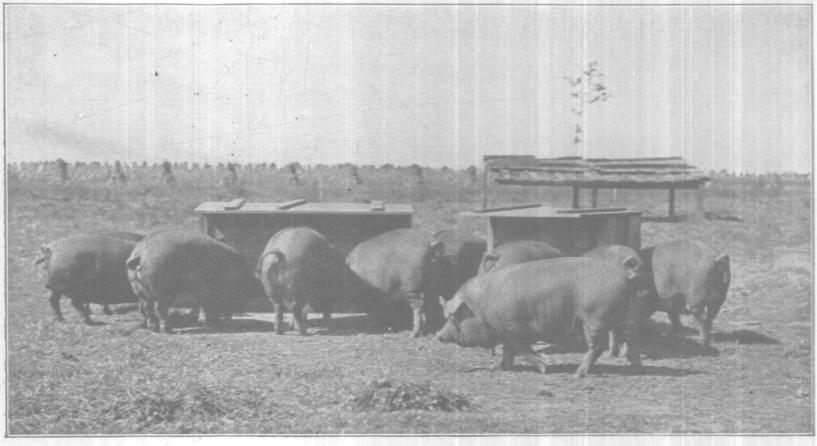
Lot 3 of Experiment I, corn, 19; tankage, 1; hand-fed full feed



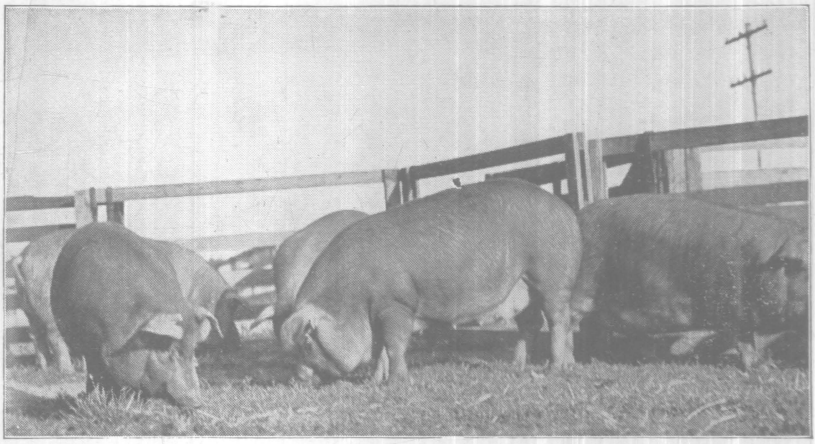
Lot 4 of Experiment I, corn, 19; tankage, 1; three-fourths of a full feed for two-thirds of test and full feed for remainder



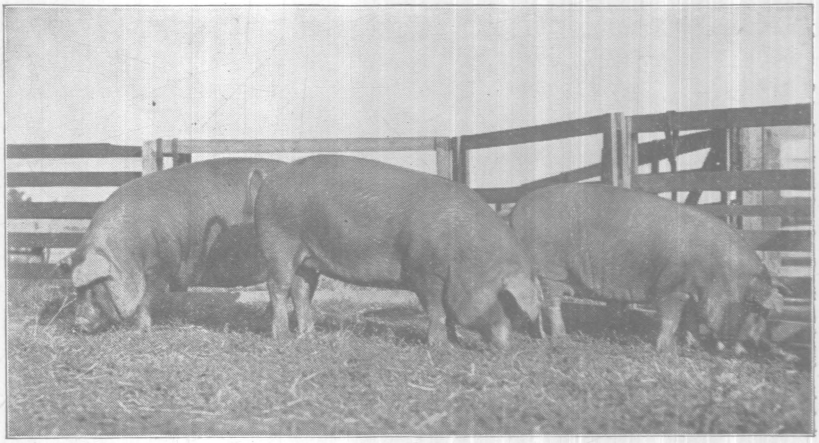
Lot 5 of Experiment I, corn, 19; tankage, 1; three-fourths of a full feed for entire time



Lot 6 of Experiment I, self-fed corn and tankage on bluegrass and white clover pasture



Lot 7 of Experiment I, self-fed corn and tankage in dry lot



Lot 8 of Experiment I, hand-fed corn, 9; tankage 1, in dry lot

The percentage yields of dressed weight are based on the live weights at Wooster, October 3, and the warm dressed weights at Canton, Ohio, October 5. During the experiment one pig was taken out of Lot 1 and two were taken out of Lot 8. At the close of the experiment one pig was saved out of each of Lots 3, 5 and 6. The percentages given are the averages for the pigs remaining. On the basis of their relative dressing percentages the pigs of Lots 1, 3, 4, 5 6, 7 and 8 were worth respectively 96.1, 98, 92.7, 96, 99.4, 99 and 99.6 percent as much as those of Lot 2. With the latter at $14 per 100 pounds the others would be worth in the order named $13.45, $13.72, $13.61, $13.43, $13.91, $13.86 and $13.94 per 100 pounds. In determining the value of the gains over the value of the feed and pasture these prices were used.

The data given in Table II showing the concentrates replaced by the pasture compare the self-fed pigs of Lots 1 and 2 with those of Lot 7 self-fed in dry lot. If a comparison is made with the pigs of Lot 8, which were hand-fed, 900.7 pounds of corn and 770.8 pounds of tankage were replaced by an acre of clover when corn alone was fed, and 1,132.9 pounds of corn and 318.8 pounds of tankage when corn and tankage were fed. In the order named this amounts to 11.4 and 31.6 bushels of corn or its equivalent in cost saved by an acre of clover. Even when the self feeding was compared with hand feeding in dry lot the replacement value of the pasture was lower than that resulting from hand feeding.

Table III gives a summary of the experiment in three intervals of 6 weeks each. Lot 1, self-fed corn alone on clover, consumed more corn per pound of increase in weight during the first period than during the second or third and more during the third than during the second. They ate less corn, that is, the daily consumption of concentrates per 100 pounds of weight was lower for the second period than for the first or third. Although as compared with the first period they made a relatively more satisfactory showing during the second and third intervals, they gained less rapidly, and with the exception of Lot 8 for the second period, required more concentrates to produce 100 pounds of gain than did the pigs of any of the other lots.

As they became older and heavier the pigs self-fed corn and tankage consumed a smaller proportion of tankage. Those on forage ate a smaller proportion of tankage than those in dry lot.

Lots 4 and 5, which were fed alike for the first two periods of the test, gained 0.872 and 0.871 pound daily per head and required 289.7 and 290.1 pounds of concentrates per 100 pounds of gain respectively during that time.

TABLE III.—EXPERIMENT I: FATTENING PIGS ON FORAGE

Experiment divided into three periods of 5 weeks each

	Lot 1 Corn alone self-fed	Lot 2 Corn and tankage self-fed	Lot 3 Corn, 19, tankage, 1 hand-fed full feed	Lot 4 Corn, 19; tankage, 1; ¾ feed for ⅔ of test	Lot 5 Corn, 19; tankage, 1; ¾ feed entire time	Lot 6 Corn and tankage self-fed	Lot 7 Corn and tankage self-fed	Lot 8 Corn, 9; tankage, 1 hand-fed
Kind of forage	Clover	Clover	Clover	Clover	Clover	Bluegrass & white clover	None	None
First Period: May 30 to July 11, 1916								
Average initial weight ..... pounds	34.35	34.20	34.85	34.5	34.3	35.2	35.60	35.60
Average daily gain ..... pounds	.561	1.036	.929	.752	.743	1.068	.793	.445
Concentrates daily per 100 pounds weight ..... pounds	5.071	5.710	4.903	4.010	4.038	4.843	5.194	4.016
Concentrates per 100 pounds gain: corn ..... pounds	417.197	275.287	272.601	254.681	257.946	224.260	288.588	364.813
tankage ..... pounds	.....	33.150	14.348	13.404	13.576	36.446	53.754	40.535
total ..... pounds	417.197	308.437	286.949	268.085	271.522	260.706	342.342	405.348
Cost of concentrates per 100 pounds gain ..... dollars	8.34	6.83	6.03	5.63	5.70	5.94	8.04	8.92
Value of gains over value of feed and pasture ..... dollars	9.15	28.57	27.11	22.57	21.16	32.78	19.77	9.39
Parts corn to tankage	.....	8.3:1	19:1	19:1	19:1	6.2:1	5.4:1	9:1
Second Period: July 11 to August 22, 1916								
Average initial weight ..... pounds	57.90	77.70	73.85	66.10	65.60	79.80	68.90	54.30
Average daily per 100 pounds weight ..... pounds	.695	1.263	1.236	.992	.999	1.256	1.407	.948
Concentrates daily per 100 pounds weight ..... pounds	3.396	4.026	4.063	3.493	3.507	4.383	4.711	4.621
Concentrates per 100 pounds gain: corn ..... pounds	354.178	297.644	311.752	290.873	288.793	342.559	292.386	325.628
tankage ..... pounds	.....	34.571	16.408	15.309	15.200	27.962	37.225	36.181
total ..... pounds	354.178	332.215	328.160	306.182	303.993	370.521	329.611	361.809
Cost of concentrates per 100 pounds gain ..... dollars	7.08	7.34	6.89	6.43	6.38	7.97	7.34	7.96
Value of gains over value of feed and pasture ..... dollars	15.03	32.17	31.58	26.42	25.60	27.79	38.55	23.80
Parts corn to tankage	.....	8.6:1	19:1	19:1	19:1	12.3:1	7.9:1	9:1
Third Period: August 22 to October 3, 1916								
Average initial weight ..... pounds	87.10	130.75	125.75	107.75	107.55	132.55	128.00	119.667
Average daily gain ..... pounds	1.146	1.669	1.681	1.664	1.281	1.949	1.774	1.413
Concentrates daily per 100 pounds weight ..... pounds	4.074	3.816	3.988	4.359	3.642	4.096	3.909	3.672
Concentrates per 100 pounds gain: corn ..... pounds	395.169	353.923	362.945	355.095	363.144	344.960	335.570	349.382
tankage ..... pounds	.....	25.135	19.102	18.689	19.113	19.609	28.591	38.820
total ..... pounds	395.169	379.058	382.945	373.784	382.257	364.569	364.161	388.202
Cost of concentrates per 100 pounds gain ..... dollars	7.90	8.08	8.02	7.85	8.03	7.68	7.88	8.54
Value of gains over value of feed and pasture ..... dollars	21.13	37.26	34.98	34.40	23.98	45.46	44.74	32.04
Parts corn to tankage	.....	14.1:1	19:1	19:1	19:1	17.6:1	11.7:1	9:1

In determining the value of the gains over the value of the feed and pasture the value of the pasture utilized per period as compared with the total value is assumed to be the same in percentage as the gains for the period are of the total gains.

EXPERIMENT II

SELF FEEDING ON CLOVER

In this experiment four lots of five pigs each were selected shortly after weaning time and self-fed for 18 weeks. The rations fed consisted of (1) ground corn and tankage self-fed separately on clover; (2) a mixture of ground corn, 19 parts, tankage, 1 part, self-fed on clover; (3) ground corn alone self-fed on clover; and (4) ground corn and tankage self-fed separately in dry lot. The clover plots contained an area of one-fourth of an acre each. The pigs in dry lot were housed in the central house and given the run of a small outside pen (10 by 40 feet) containing no green feed. The results of the test are given in Table IV.

TABLE IV.—EXPERIMENT II: SELF FEEDING ON CLOVER

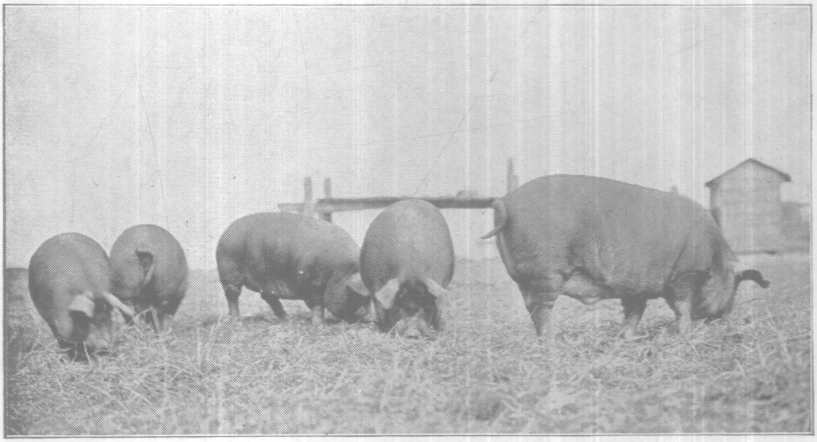
June 13 to October 17, 1917

Five pigs per lot	Lot 1 Corn and tankage	Lot 2 Corn, 19; tankage, 1	Lot 3 Corn alone	Lot 4 Corn and tankage dry lot
Average initial weight ..... pounds..	42.6	43.5	43.8	44.2
Total gain ..... pounds..	879	924.75	733	936
Average daily gain ..... pounds..	1.395	1.468	1.163	1.486
Concentrates consumed: corn ..... pounds..	3,375.8	3,595.156	3,065	3,577
tankage ..... pounds..	144	189.219	.....	228.5
total ..... pounds.	3,519.8	3,484.375	3,065	3,805.5
Daily concentrates per pig ..... pounds..	5.587	6.007	4.865	6.040
Concentrates daily per 100 pounds weight ... pounds..	4.281	4.447	4.155	4.384
Concentrates per 100 pounds gain: corn ..... pounds.	384.050	388.770	418.145	382.158
tankage ..... pounds..	16.382	20.462	.....	24.412
total ..... pounds..	400.432	409.232	418.145	406.570
Cost of concentrates per 100 pounds gain ..... dollars	8.34	8.59	8.36	8.62
Value of pasture utilized ..... dollars..	6.00	6.00	6.00	.....
Value of gains over value of feed and pasture. dollars	43.98	43.99	35.32	50.36
Concentrates replaced by an acre of pasture: corn ..... pounds.	—66.521	—244.595	—1 055.124	.....
tankage ..... pounds.	282.340	146.138	715.771	.....
Corn or its equivalent in cost saved by an acre of pasture ..... bushels..	8.896	.851	6.720	.....
Gain accredited to an acre ..... pounds..	119.170	—8.341	40.597	.....
Parts corn to tankage consumed	23.44:1	19:1	.....	15.65:1

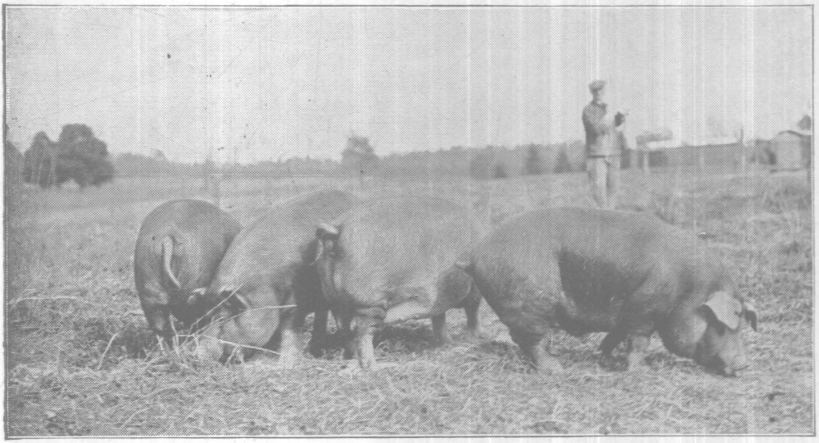
On August 8 a pig was taken out of Lot 2, weight 116 pounds. Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds.

The pigs in the lot given no tankage gained more slowly and those with no green feed more rapidly than those of the three lots with which they were compared. There was very little difference in the amount of concentrates required per unit of gain for any of

the lots. The pigs of Lots 1 and 2 getting tankage required respectively 4.2 and 2.1 percent less of concentrates per unit of gain than those allowed no tankage. The pigs in the dry lot consumed 1 pound of tankage to 15.7 pounds of corn while those on clover that were given the same ration and were similarly fed ate only 1 pound of tankage to 23.4 pounds of corn.



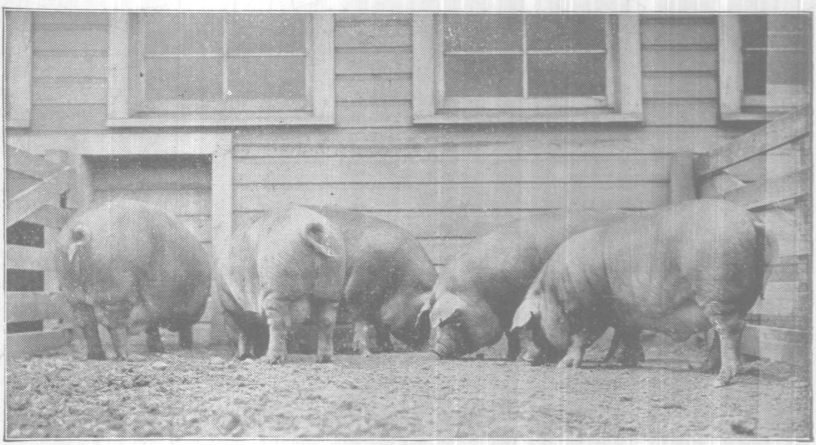
Lot 1 of Experiment II, self-fed corn and tankage separately on clover



Lot 2 of Experiment II, self-fed mixture of corn, 19; tankage, 1, on clover

The average daily consumption of tankage per pig by those on clover self-fed corn and tankage separately, those fed the mixture of corn, 19 parts; tankage, 1 part and those fed in dry lot was 0.23, 0.29 and 0.36 of a pound respectively.

Lot 3 of Experiment II, self-fed corn alone on clover



Lot 4 of Experiment II, self-fed corn and tankage in dry lot

EXPERIMENT III

FULL AND LIMITED FEEDING ON CLOVER PASTURE

Experiment III was conducted for the purpose of comparing full and limited feeding of concentrates on clover pasture. The pigs used were from 10 to 12 weeks of age at the beginning of the test. Lots 1 and 4 were full-fed or given all the concentrates they would clean up readily twice daily. Lots 2 and 3 were fed limited rations of concentrates and received daily 3 and 2 pounds per 100 pounds of live weight, respectively. Rations of shelled corn and tankage were used. The pigs on clover were started on a ration of corn, 9 parts; tankage, 1 part. The corn was increased 1 part, 1⅛ parts and 1¼ parts weekly for Lots 1, 2 and 3, respectively. The pigs in dry lot were started on corn, 8 parts; tankage, 1 part, and the corn increased 0.4 part weekly. Lots 1 and 2 were provided with one-eighth of an acre of clover each and Lot 3 with one-fourth of an acre. Since the plots did not furnish sufficient pasture to carry the pigs throughout the summer the test was closed at the end of 12 weeks. Before the close of the test it became necessary to allow Lots 2 and 3 additional clover and they were placed on plots which were previously pastured by older hogs. It was estimated that Lots 1, 2 and 3 had clover approximately equivalent to one-eighth, three-sixteenths and three-eighths of an acre, respectively. Table V gives the results of the test.

TABLE V.—EXPERIMENT III: FULL AND LIMITED FEEDING ON CLOVER PASTURE

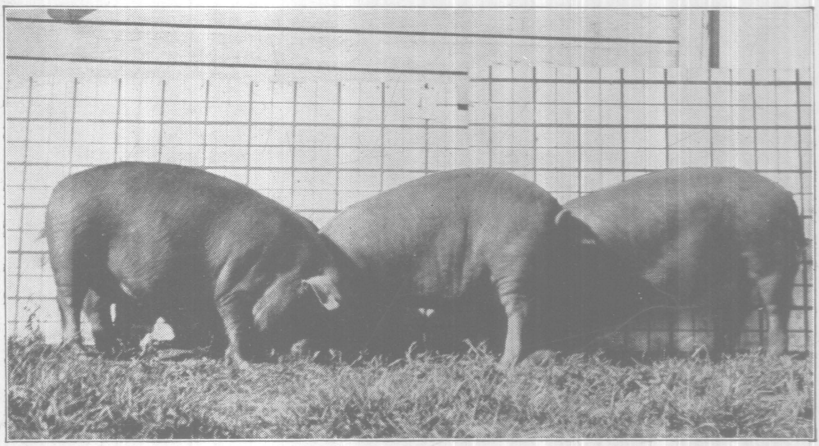
June 1 to August 24, 1917

Five pigs per lot	Lot 1 Corn and tankage	Lot 2 Corn and tankage 3% feed	Lot 3 Corn and tankage 2% feed	Lot 4 Corn and tankage full feed dry lot
Average initial weight ..... pounds..	48 4	48.1	48.3	48.1
Total gain ..... pounds..	434.375	261.5	211	326.5
Average daily gain ..... pounds.	1.034	.623	.502	.777
Concentrates consumed: corn ..... pounds..	1,513.521	858.094	528.940	1,212.513
tankage ..... pounds .	102.104	56.675	33.990	116.987
total ..... pounds..	1,615.625	914.769	562.930	1,329 500
Daily concentrates per pig ..... pounds .	3.847	2 178	1.340	3.165
Concentrates daily per 100 pounds weight .pounds..	4.189	2.933	1.931	3.920
Concentrates per 100 pounds gain: corn ..... pounds.	348 436	328.143	250.682	371.367
tankage ..... pounds .	23.506	21.673	16.109	35.831
total ..... pounds..	371 942	349 816	266.791	407.198
Cost of concentrates per 100 pounds gain .... dollars..	7.91	7.43	5.66	8.86
Value of pasture utilized ..... dollars	3.00	4.50	7.50	.....
Value of gains over value of feed and pasture. dollars	23.46	12.68	10.10	16.78
Concentrates replaced by an acre of pasture: corn ..... pounds .	796.836	602.831	814.861	.....
tankage ..... pounds..	428.278	197.451	133.160	.....
Corn or its equivalent in cost saved by an acre of pasture ..... bushels..	29.525	17.817	19.307	.....
Gain accredited to an acre* ..... pounds..	374.065	219.632	241.860	.....
Parts corn to tankage consumed	14.82:1	15.14:1	15.56:1	10.36:1

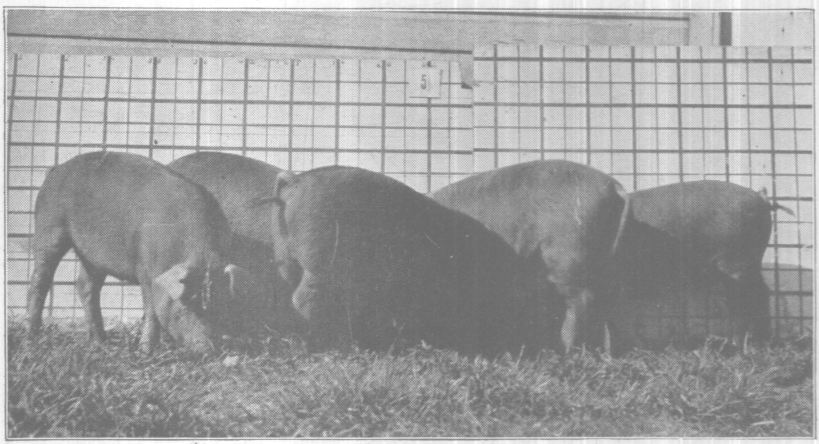
Pig taken out of Lot 1 July 6, weight 48.5 pounds. Corn, $1.12 per bushel; tankage, $80 per ton; clover, $24 per acre; hogs, $14 per 100 pounds.

*On the assumption that for Lot 1, 2.013 pounds, and for Lots 2 and 3, 1.792 pounds of corn were replaced by a pound of tankage.

The pigs full-fed on clover gained more rapidly and consumed a larger amount of concentrates daily per 100 pounds of weight, than the full-fed pigs with no green feed. The clover decreased the amount of concentrates required to produce 100 pounds of gain.



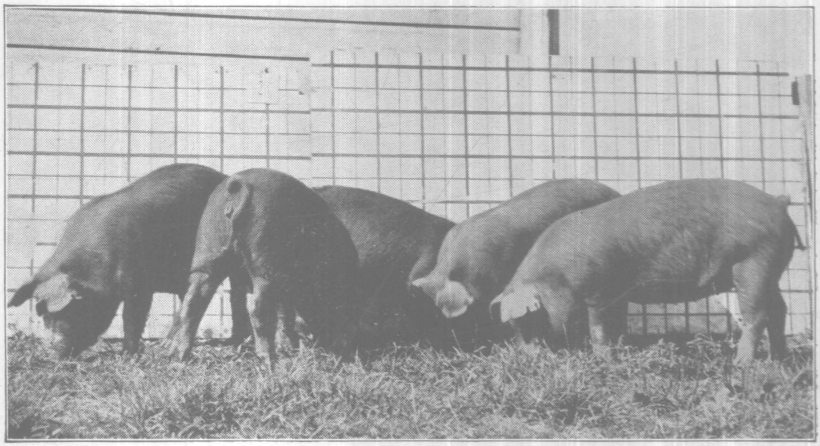
Lot 1 of Experiment III, full feed of corn and tankage on clover pasture



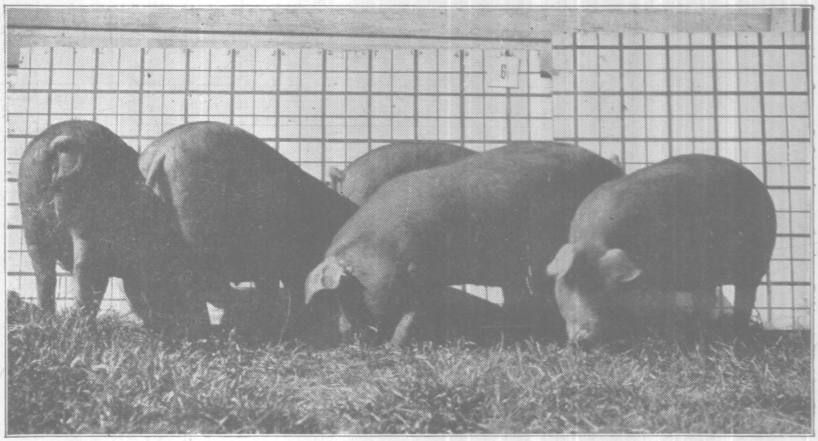
Lot 2 of Experiment III, three percent feed of corn and tankage on clover pasture

Each decrease in the amount of grain fed to the pigs on pasture decreased the amount needed per unit of gain. As compared with full feeding the 3 percent ration resulted in a reduction of 5.9 percent while the 2 percent ration resulted in the marked reduction of 28.3 percent in the amount of concentrates required per unit of gain.

Based on these results 500 bushels of corn would be sufficient to last 159 pigs given a 2 percent feed, 98 given a 3 percent feed or 55 given a full feed for a grazing period of 20 weeks. At the close



Lot 3 of Experiment III, two percent feed of corn and tankage on clover pasture



Lot 4 of Experiment III, full feed of corn and tankage in dry lot

of that time, however, the full-fed pigs would be ready for market while the others would not and 16.5, 6.1 and 2.3 acres of pasture would have been utilized by the pigs fed light, medium and heavy rations respectively.

FEEDING ON RAPE PASTURE

EXPERIMENT IV

LIMITED FEEDING ON RAPE PASTURE

Table VI shows the results of an experiment in which two lots of pigs on rape pasture were given limited rations, one of corn alone and the other of corn and tankage. A third lot was given a full feed of corn and tankage in dry lot. Ten percent of tankage was used in both the rations containing it. Approximately four-fifths of a full feed of concentrates was allowed the pigs on forage. The rape was seeded May 18 and was drilled solid. Each plot contained one-fourth of an acre. The pigs ranged from 12 to 13 weeks of age at the beginning of the test.

TABLE VI.—EXPERIMENT IV: LIMITED FEEDING ON RAPE PASTURE

June 30 to September 22, 1914			
Six pigs in each lot	Lot 1 Corn alone	Lot 2 Corn, 9; tankage, 1	Lot 3 Corn, 9; tankage 1; full feed, dry lot
Average initial weight ..... pounds..	51	52.08	53.25
Total gain ..... pounds..	445.7	593.5	625
Average daily gain ..... ponnds..	.884	1.178	1.240
Concentrates consumed: corn ..... pounds..	1,467.24	1,658.25	1,984.950
tankage ..... pounds..	.....	184.25	220.550
total ..... pounds..	1,467.24	1,842.5	2,205.500
Daily concentrates per pig ..... pounds..	2.911	3.656	4.376
Concentrates daily per 100 pounds weight ..... pounds..	3.303	3.600	4.154
Concentrates per 100 pounds gain: corn ..... pounds..	329.199	279.402	317.592
tankage ..... pounds..	.....	31.045	35.288
total ..... pounds..	329.199	310.447	352.880
Cost of concentrates per 100 pounds gain ..... dollars..	6.58	6.83	7.76
Value of pasture utilized ..... dollars..	4.80	4.80	.....
Value of gains over value of feed and pasture ..... dollars..	28.25	37.75	38.98
Concentrates replaced by an acre of pasture: corn ..... pounds..	—258.662	1,133.293	.....
tankage ..... pounds..	786.393	125.921	.....
Corn or its equivalent in cost saved by an acre of pasture. bushels..	23.466	24.735	.....
Gains accredited to an acre ..... pounds..	267.975	356.839	.....

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 an acre; hogs, $14 per 100 pounds.

In addition to increasing the rate of gain and lowering the pounds of concentrates required per unit of gain the use of a small amount of tankage in the ration increased the replacement value of the pasture. Since the pigs in dry lot were full-fed while the others received limited grain allowances their higher rate of gain is not surprising. For each 100 pounds of gain produced they required 13.7 percent more concentrates than did the pigs fed a similar ration on forage.

Rape plots June 30, 43 days after seeding; two plots at right used in Experiment IV

EXPERIMENTS V AND VI

FULL AND LIMITED FEEDING ON RAPE PASTURE

Table VII gives the results of Experiments V and VI. Since purebred Duroc-Jersey pigs were used in Experiment V and cross-bred Tamworth-Duroc-Jerseys differing in age and weight were used in Experiment VI the two are not comparable. Both tests

TABLE VII.—EXPERIMENTS V AND VI: FULL AND LIMITED FEEDING ON RAPE PASTURE

June 29 to October 9, 1916

	Ration: corn, 14; tankage, 1			
	Experiment V		Experiment VI	
	Lot 1 Full feed	Lot 2 2%, 3% and full feed	Lot 1 3% feed	Lot 2 2%, 3% and full feed
Pigs per lot.....number..	8	6	6	6
Average initial weight.....pounds..	39.875	40.583	52.083	52.333
Total gain.....pounds..	1,059.714	703	683	766
Average daily gain.....pounds..	1.262	1.116	1.084	1.216
Concentrates consumed: corn.....pounds..	3,501.600	1,919.139	1,846.208	2,107.280
tankage.....pounds..	250.114	137.081	131.872	150.520
total.....pounds..	3,751.714	2,056.220	1,978.080	2,257.800
Daily concentrates per pig.....pounds..	4.466	3.264	3.140	3.584
Concentrates daily per 100 pounds weight...pounds..	4.209	3.296	2.881	3.085
Concentrates per 100 pounds gain: corn.....pounds..	**330.429**	**272.993**	**270.309**	**275.102**
tankage.....pounds..	**23.602**	**19.499**	**19.308**	**19.650**
total.....pounds..	**354.031**	**292.492**	**289.616**	**294.725**
Cost of concentrates per 100 pounds gain.....dollars..	7.55	6.24	6.18	6.29
Value of pasture utilized.....dollars..	6.00	6.00	6.00	6.00
Value of hogs per 100 pounds.....dollars..	14.00	13.94	13.65	13.80
Value of gains over value of feed and pasture (on basis of 6 pigs per lot).....dollars..	46.74	48.13	45.03	51.54
Yield in dressed weight*.....percent..	80.380	80.043	78.362	79.236

Pig taken out of Lot 1, Experiment V, August 21, weight 95 pounds. Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre.

*Live weight immediately before killing and warm dressed weight.

began June 26 and closed October 9. All four lots received a ration of ground corn, 14 parts; tankage, 1 part, and each lot was given the run of rape plots containing one-fourth of an acre. Lot 1 of

Experiment V was given a full feed of concentrates, or all they would clean up readily twice daily. The daily allowance of concentrates for Lot 2 for the first and second third of the test was intended to be approximately 2 percent and 3 percent of the weight of the pigs. For the last third of the test they were given all they would clean up readily twice daily. Lot 1 of Experiment VI was fed approximately 3 pounds of concentrates daily per 100 pounds of live weight. The plan of feeding for Lot 2 was the same as that for Lot 2 of Experiment V.

The full-fed pigs gained more rapidly than those fed a limited ration in comparison but at the prices given because of a higher concentrate requirement per unit of gain the value of the gain over the charge for feed and forage was slightly less than that for the pigs given a smaller amount of concentrates. This is on the basis of an equal number of pigs per lot.

TABLE VIII.—EXPERIMENTS V AND VI: FULL AND LIMITED FEEDING ON RAPE PASTURE

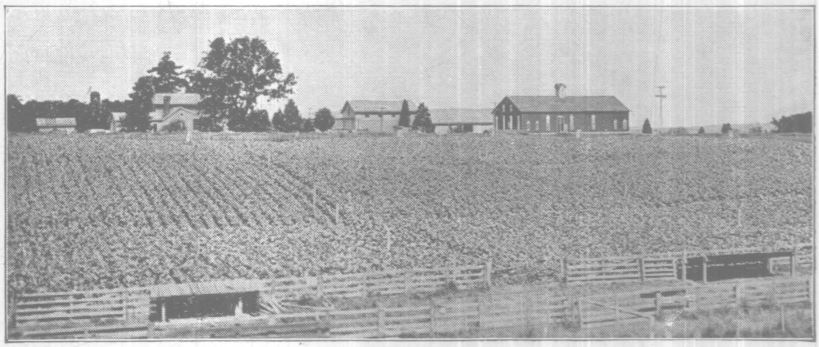
Experiments divided into 3 periods of 5 weeks each

	Experiment V		Experiment VI	
	Lot 1	Lot 2	Lot 1	Lot 2
First period: June 26 to July 31				
	Full feed	2 percent feed	3 percent feed	2 percent feed
Average initial weight ..... pounds..	39.875	40.583	52.083	52.333
Average daily gain..... pounds..	.927	.660	.902	.788
Concentrates daily per 100 pounds weight... pounds..	3.884	2.120	3.004	2.011
Concentrates per 100 pounds gain..... pounds..	235.067	167.523	225.953	168.701
Cost of concentrates per 100 pounds gain .... dollars..	5.01	3.57	4.82	3.60
Value of gains over value of feed and pasture. dollars..	16.38	13.17	15.07	15.58
Second period: July 31 to September 4				
	Full feed	3 percent feed	3 percent feed	3 percent feed
Average initial weight..... pounds..	72.312	63.667	83.677	79.75
Average daily gain..... pounds..	1.248	.983	1.105	1.102
Concentrates daily per 100 pounds weight... pounds..	5.081	2 992	2.989	3.005
Concentrates per 100 pounds gain ..... pounds..	383.398	246.102	278.642	270.454
Cost of concentrates per 100 pounds gain .... dollars..	8.18	5.25	5.94	5.75
Value of gains over value of feed and pasture. dollars..	13.79	16.18	15.84	16.78
Third period: September 4 to October 9				
	Full feed	Full feed	3 percent feed	Full feed
Average initial weight ..... pounds..	116.143	98.083	122.333	118.5
Average daily gain..... pounds..	1.610	1.705	1.245	1.757
Concentrates daily per 100 pounds weight... pounds..	4.460	4.899	2.985	4.315
Concentrates per 100 pounds gain ..... pounds..	399.747	367.598	345.488	366.531
Cost of concentrates per 100 pounds gain .... dollars..	8.53	7.84	7.37	7.82
Value of gains over value of feed and pasture. dollars..	16.57	18.78	14.12	19.18

Pig taken out of Lot 1, Experiment V, August 21, weight 95 pounds.

The pigs of Experiment VI which were given a constant daily allowance of concentrates equal to 3 percent of their weight did not gain as rapidly as those which were first given a 2 percent feed, then a 3 percent feed and finally for the last third a full feed. The former required slightly less feed per unit of gain. The pigs which were given limited rations at first and allowed a full feed during the latter part of the test showed greater margins over the value of the feed and pasture than those full-fed or those fed a limited ration throughout the feeding period.

In Table VIII the results of the two experiments are given in three periods of 5 weeks each. The concentrates required per unit of gain varied with the amounts fed per unit of weight. When similarly fed those which previously received the lightest rations required the fewest pounds per unit of gain.



Experiments V and VII, rape seeded in rows 24 inches apart, taken July 3, 59 days after seeding

EXPERIMENT VII

FULL AND LIMITED FEEDING ON RAPE PASTURE

In Experiment VII a comparison of full and limited rations of concentrates when used with rape pasture was made. Four lots of five pigs each were placed on the forage and a fifth lot of four pigs was used as a check and given no green feed. The pigs were from 10 to 14 weeks of age at the beginning of the test. The experiment was continued for 21 weeks. The ration first used consisted of 14 parts of white middlings to 1 part of tankage by weight. After 4 weeks the supply of middlings was exhausted, and, since no more could be procured at the time, hominy feed was substituted for the middlings. Lot 1 was given a full feed (what they would

clean up readily twice daily) of concentrates throughout the experiment. For the first third of the test Lot 2 was given approximately 2 pounds of concentrates daily per 100 pounds of live weight. This was increased to 3 pounds for the second third and to a full feed for the last third of the test. For each third of the experiment, respectively, Lot 3 was fed approximately 1 pound, 2 pounds and 3 pounds of concentrates daily per 100 pounds of live weight. Lot 4 was to have received only 1 pound of concentrates daily per 100 pounds of weight but toward the close of the test the pigs of this lot began losing in weight and the allowance of concentrates was increased somewhat. Lot 5, which had no pasture, received a full feed of concentrates throughout the test. Table IX gives the results of the experiment.

TABLE IX.—EXPERIMENT VII: FULL AND LIMITED FEEDING ON RAPE PASTURE

June 26 to November 20, 1917

	Lot 1 Full feed	Lot 2 2%, 3% and full feed	Lot 3 1, 2 and 3% feed	Lot 4 1% feed	Lot 5 full feed dry lot
Pigs per lot.....number..	5	5	5	5	4
Average initial weight.....pounds..	35.5	35.6	35.5	35.2	36
Total gain.....pounds..	924.125	783	529.875	314.625	606.5
Average daily gain.....pounds..	1.257	1.065	.721	.428	1.031
Concentrates consumed; middlings..... pounds..	267.867	139.720	69.160	69.160	215.6
hominy feed... .....pounds..	3,250.100	2,360.307	1,413.382	602.023	2,149.
tankage.....pounds..	251.283	178.573	105.896	47.942	168.9
total.....pounds..	3,769.250	2,678.600	1,588.438	719.125	2 533.5
Daily concentrates per pig.....pounds..	5.128	3.644	2.161	.978	4.309
Concentrates daily per 100 lbs. weight...pounds..	4.009	3.200	2.442	1.468	3.853
Concentrates per 100 pounds gain:					
middlings and hominy feed.....pounds..	380.681	319.288	279.791	213.328	389.876
tankage..... .....pounds..	27.191	22.806	19.985	15.238	27.848
total..... .....pounds..	407.872	342.094	299.776	228.566	417.724
Cost of concentrates per 100 pounds gain..dollars..	8.64	7.26	6.37	4.83	8.84
Average yield in dressed weight.....percent..	81.359	78	75.569	71.934	78.196
Value of pasture utilized.....dollars..	4.50	6.00	7.50	6.00	
Value of hogs per 100 pounds.....dollars..	14.00	13.42	13.00	12.38	13.46
Value of gains over value of feed and pasture..... .....dollars..	45.00	42.21	27.64	17.75	35.02
Concentrates replaced by an acre of pasture: middlings and hominy feed.pounds..	1,303.236	2,210.819	1,867.109	2,221.862	
tankage.....pounds..	93.093	157.917	133.329	158.703	
Corn or its equivalent in cost saved by an acre of pasture.....bushels..	26.001	44.129	37.413	45.039	
Gains accredited to an acre*.....pounds..	335.228	567.057	478.883	569.888	

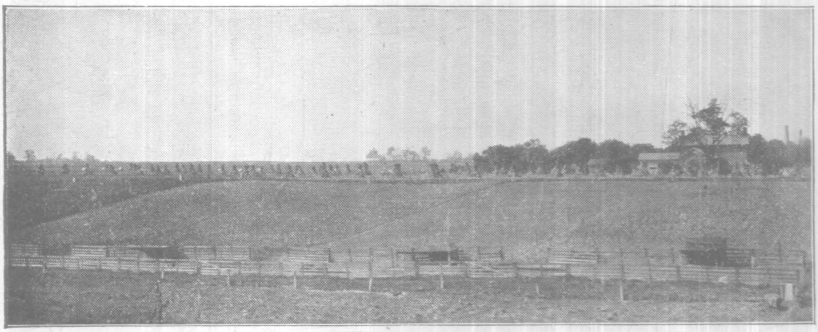
Hominy feed, $40; middlings, $36, and tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds. Pig taken out of Lot 1, August 21, weight 65 pounds; one taken out of Lot 3 October 9, weight 86.5 pounds; one taken out of Lot 4 August 21, weight 47 pounds. Dressing percentages based on fasted live weights and cooled dressed weights.

*On the assumption that for Lot 1, 2.117 pounds and for Lots 2, 3 and 4, 1.792 pounds of middlings and hominy feed were replaced by a pound of tankage.

The pigs full-fed on rape pasture gained more rapidly and required slightly less feed per unit of gain than those similarly fed in dry lot. Each reduction in the concentrates fed reduced the amount needed per unit of gain but also resulted in a marked

reduction in the rate of gain. The pigs of Lot 4 required only 228.6 pounds of concentrates per 100 pounds of gain as compared with 407.9 pounds for those of Lot 1. The latter, however, gained practically three times as fast. Because of their very slow growth the pigs of Lot 4 did not have the capacity to utilize green feed to any great extent. They ate less forage than did Lot 3. The gain accredited to an acre of forage was greater for Lot 2 than for either Lots 1 or 3. With the other prices used and the gains for both lots at $14 per 100 pounds, or the higher dressing percentage of Lot 1 not taken into consideration, the value of the gains over the charge for feed and pasture was also higher for Lot 2 than for Lot 1.

All the pigs in Lot 4 were slaughtered. One pig was taken out of each of Lots 2, 3 and 5 and two out of Lot 1 and retained for breeding purposes. In each case the average weight of those



Experiment VII, rape plots after being pastured for 104 days by Lots 1, 2, 3 and 4, respectively, from left to right

slaughtered was slightly lower than the average for the entire lot. The dressing percentages given in the table are based on the live weights just before killing, after the pigs were without feed for 24 hours and were shipped, and the dressed weights after the carcasses were in the coolers for 48 hours. The differences in their dressing percentages would make the pigs of Lots 2, 3, 4 and 5, 4.129, 7.117, 11.584 and 3.888 percent less valuable per 100 pounds than those of Lot 1. This with the latter at $14 per 100 pounds would give the others as named a comparative market value of $13.42, $13, $12.38 and $13.46 per 100 pounds,respectively.

During the last few weeks of the test Lot 1 had practically no green feed. Because of this the gains for the lot accredited to the forage are based on the results for the first 18 weeks. The other

lots had plenty of green feed up to the close of the experiment and the gains accredited to the rape in their cases are based on the results for the full period of 21 weeks.

TABLE X.—EXPERIMENT VII: FULL AND LIMITED FEEDING ON RAPE PASTURE

(Experiment divided into three periods of 7 weeks each)

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
First period: June 26 to August 14					
Concentrates daily per 100 lbs. weight...pounds..	4.546	2.497	1.280	1.339	4.693
Average initial weight.....pounds..	35.5	35.6	35.5	35.2	36.
Average daily gain.....pounds.	.649	.431	.369	.302	.607
Concentrates per 100 ponnds gain.....pounds.	360.063	267.583	154.365	188.784	393.277
Cost of concentrates per 100 pounds gain..dollars.	7.34	5.44	3.14	3.84	8.03
Value of gains over value of feed and pasture.....dollars..	9.81	7.61	7.64	4.91	8.08
Second period: August 14 to October 2					
Concentrates daily per 100 lbs. weight...pounds..	5.142	3.548	2.456	1.348	4.912
Average initial weight.....pounds..	67.3	56.7	53.6	50.	65.75
Average daily gain.....pounds..	1.513	1.127	.722	.556	1.355
Concentrates per 100 pounds gain . ....pounds..	354.653	265.471	242.401	154.234	358.757
Cost of concentrates per 100 pounds gain..dollars..	7.57	5.66	5.17	3.29	7.65
Value of gains over value of feed and pasture.....dollars.	22.05	19.29	11.35	9.79	19.27
Third period: October 2 to November 20					
Concentrates daily per 100 lbs. weight...pounds..	4.193	4.466	3.612	1.688	3.552
Average initial weight.....pounds..	143.75	111.9	89.	78.875	132.125
Average daily gain.....pounds..	1.610	1.639	1.071	.426	1.133
Concentrates per 100 pounds gain.....pounds..	477.179	414.346	388.637	353.804	501.351
Cost of concentrates per 100 pounds gain..dollars..	10.18	8.84	8.29	7.55	10.70
Value of gains over value of feed and pasture.....dollars.	13.15	15.31	8.64	3.05	7.67

A 65-pound pig was taken out of Lot 1 on August 21; 86.5-pound pig, out of Lot 3 on October 9; and a 47-pound pig out of Lot 4 on August 21.

Table X gives the results of Experiment VII in three periods of 7 weeks each. During the third period, although they were somewhat lighter in weight and required 13 percent less of concentrates per unit of gain, the pigs of Lot 2 gained slightly more rapidly than those of Lot 1 that were full-fed from the beginning. This indicates that the condition or finish of the pigs influenced both the rate and economy of gains. It was only during this period that the value of their gains over the value of the feed and pasture was greater than that of the full-fed pigs of Lot 1.

EXPERIMENT VIII

PROPORTIONS OF TANKAGE WITH FULL AND LIMITED FEEDING

Experiment VIII compares full and limited feeding on rape pasture. Rations of corn alone and of corn and tankage containing 5 and 10 percent of tankage, respectively, were used. As a check a seventh lot without access to green feed was fed corn and tankage. The experiment continued for 18 weeks. Twice daily throughout the test each of the three full-fed lots received all the concentrates they would clean up readily. The pigs fed the limited rations were given approximately 2 pounds of concentrates daily per 100 pounds of weight for the first 6 weeks and 3 pounds for the second 6-week period. For the last 6 weeks of the test they were given a full feed of concentrates.

At the beginning of the experiment the pigs were from 8 to 14 weeks of age. Table XI shows the number of pigs in each lot, their average initial weight, the rations fed and the results secured. Each plot of rape contained an area of ½ acre. All the plots furnished sufficient forage throughout the experiment.

All the lots fed limited rations required fewer pounds of concentrates per unit of gain but gained more slowly than the lots full fed similar rations.

Of the full-fed pigs those fed corn alone gained at a lower rate, required a larger amount of concentrates per unit of gain, which at the prices used cost more for each 100 pounds of gain produced, and gave a smaller return for the pasture utilized than the pigs of the two lots given tankage in addition to corn. The pigs allowed 5 percent of tankage in the ration gained hardly as rapidly as those allowed 10 percent. However, feeding the smaller proportion of tankage proved more economical than feeding the larger proportion.

With the limited feeding fewer pounds of concentrates per unit of gain were required when the larger proportion of tankage was fed. Inasmuch as 5 percent of tankage proved sufficient in the case of full feeding and, with the gains valued at the same price per 100 pounds, this method of feeding gave larger returns than full feeding for the entire time in Experiments V and VII when 6⅔ percent of tankage was fed, it would seem that possibly this is the result of something other than the ration fed.

At the prices used the pigs fed the limited ration containing the larger proportion of tankage gave a greater return over the value of the feed and pasture than did the pigs full-fed a similar ration. With the other two rations the returns from full-feeding were greater than were those from feeding limited amounts of concentrates.

TABLE XI.—EXPERIMENT VIII: PROPORTIONS OF TANKAGE WITH FULL AND LIMITED FEEDING ON RAPE PASTURE

June 18 to October 22, 1918

	Lot 1 Corn alone full feed	Lot 2 Corn alone 2%, 3% and full feed	Lot 3 Corn, 19; tankage, 1 full feed	Lot 4 Corn, 19; tankage, 1 2%, 3% and full feed	Lot 5 Corn, 9; tankage, 1 full feed	Lot 6 Corn, 9; tankage, 1 2%, 3% and full feed	Lot 7 Corn, 9; tankage, 1 full feed dry lot
Pigs.....number..	9	6	10	6	10	6	4
Average initial weight.....pounds..	36.28	34.75	36.35	35.17	35.15	35.00	36.375
Total gain.....pounds..	1,002.929	476.0	1,336.5	642.0	1,387.5	721.5	299.5
Average daily gain.....pounds..	**.884**	**.630**	**1.062**	**.849**	**1.101**	**.954**	**.594**
Concentrates consumed: corn.....pounds..	4,240.143	1,740.5	4,821.25	1,993.195	4,749.750	1,875 87	1,213.2
tankage.....pounds..	.....	.....	253.75	104.905	527.75	208.43	134.8
total.....pounds..	4,240.143	1,740.5	5,075.0	2,098.1	5,277.5	2,084.30	1,348.0
Daily concentrates per pig.....pounds..	3.739	2.302	4.031	2.775	4.188	2.757	2.675
Concentrates daily per 100 pounds weight.....pounds..	4.109	3.094	3.885	3.130	4.007	2.898	3.624
Concentrates per 100 pounds gain: corn.....pounds..	**422.776**	**365.651**	**360.737**	**310.467**	**342.324**	**259.996**	**405.075**
tankage.....pounds..	.....	.....	**18.986**	**16.340**	**38.036**	**28.888**	**45.008**
total.....pounds..	**422.776**	**365.651**	**379.723**	**326.807**	**380.360**	**288.884**	**450.083**
Cost of concentrates per 100 pounds gain.....dollars..	8.46	7.31	7.97	6.86	8.37	36.36	9.90
Yield in dressed weight.....percent..	76.087	71.901	76.876	75.513	76.668	75.163	74.184
Value of pasture utilized.....dollars..	12.00	12.00	12.00	12.00	12.00	12.00	.....
Value of hogs per 100 pounds.....dollars..	13.89	13.13	14.04	13.79	14.00	13.73	13.55
Value of gains over value of feed and pasture.....dollars..	47.23	26.15	69.12	54.12	66.14	68.68	27.32
Concentrates replaced by an acre of pasture: corn.....pounds..	—355.054	375.315	1,185.158	1,214.775	1,741.335	2,093.494	.....
tankage.....pounds..	902.804	428.479	695.573	368.097	193.482	232.610	.....
Corn or its equivalent in cost saved by an acre of pasture.....bushels..	25.903	22.005	46.005	34.839	38.005	45.691	... .
Gain accredited to an acre of pasture.....pounds..	365.940	339.401	625.250	441.235	429.880	516.817	.....

Two pigs taken out of Lot 1 July 16, weight 55.5 pounds; 18.5-pound pig in Lot 3 died June 24 and was replaced with a 30-pound one on June 25; two pigs were taken out of Lot 7 September 10, weight 90.5 pounds.

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds.

TABLE XII.—EXPERIMENT VIII: PROPORTIONS OF TANKAGE WITH FULL AND LIMITED FEEDING ON RAPE PASTURE

Experiment divided into three periods of 6 weeks each

	Lot 1 Corn alone	Lot 2 Corn alone	Lot 3 Corn, 19; tankage, 1	Lot 4 Corn, 19; tankage, 1	Lot 5 Corn, 9; tankage, 1	Lot 6 Corn, 9; tankage, 1	Lot 7 Corn, 9; tankage, 1 dry lot
First Period: June 18 to July 30							
	Full feed	2% feed	Full feed	2% feed	Full feed	2% feed	Full feed
Average initial weight.....pounds..	35.28	34.75	36.35	35.17	35.15	35.00	36.375
Average daily gain.....pounds..	.531	.290	.703	.377	.685	.369	.286
Concentrates daily per 100 pounds weight.....pounds..	4.864	2.091	4.417	2.058	4.596	2.063	3.842
Concentrates per 100 pounds gain: corn.....pounds..	425.417	294.795	308.387	223.400	299.270	215.032	512.813
tankage.....pounds..	.....	.....	16.231	11.758	33.252	23.893	56.979
total.....pounds..	425.417	294.795	324.618	235.158	332.522	238.925	569.792
Cost of concentrates per 100 pounds gain.....dollars..	8.51	5.90	6.82	4.94	7.32	5.26	12.54
Value of gains over value of feed and pasture.....dollars..	8.22	5.74	18.67	11.06	16.73	10.56	1.22
Second Period: July 30 to September 10							
	Full feed	3% feed	Full feed	3% feed	Full feed	3% feed	Full feed
Average initial weight.....pounds..	62.93	46.92	66.95	51.00	63.90	50.50	48.375
Average daily gain.....pounds..	.956	.595	1.113	.671	1.127	.829	.449
Concentrates daily per 100 pounds weight.....pounds..	4.598	3.120	4.631	2.928	4.996	2.917	3.598
Concentrates per 100 pounds gain: corn.....pounds..	399.288	309.867	357.037	269.935	349.261	213.416	416.623
tankage.....pounds..	.....	.....	18.792	14.207	38.807	23.713	46.291
total.....pounds..	399.288	309.867	375.829	284.142	388.068	237.129	462.914
Cost of concentrates per 100 pounds gain.....dollars..	7.99	6.20	7.89	5.97	8.54	5.22	10.18
Value of gains over value of feed and pasture.....dollars..	17.53	11.03	24.54	16.77	21.77	23.86	6.35
Third Period: September 10 to October 22							
	Full feed	Full feed	Full feed	Full feed	Full feed	Full feed	Full feed
Average initial weight.....pounds..	103.07	71.92	113.700	79.170	111.25	85.33	89.25
Average daily gain.....pounds..	1.167	1.004	1.368	1.486	1.492	1.665	1.048
Concentrates daily per 100 pounds weight.....pounds..	4.031	4.525	3.949	5.000	4.148	4.508	3.879
Concentrates per 100 pounds gain: corn.....pounds..	440.816	419.170	390.583	350.469	356.839	293.170	370.739
tankage.....pounds..	.....	.....	20.557	18.446	39.649	32.575	41.193
total.....pounds..	440.816	419.170	411.140	368.915	396.488	325.745	411.932
Cost of concentrates per 100 pounds gain.....dollars..	8.82	8.38	8.63	7.75	8.72	7.17	9 06
Value of gains over value of feed and pasture.....dollars..	17.47	9.38	25.90	26.29	27.64	34 26	19.75

Lot 1 of Experiment VIII, fed corn alone on rape pasture; full feed

Lot 2 of Experiment VIII, fed corn alone on rape pasture; 2 percent, 3 percent and full feed for each one-third of test respectively

Lot 3 of Experiment VIII, fed corn, 19; tankage, 1, on rape pasture; full feed

Lot 4 of Experiment VIII, fed corn, 19; tankage, 1, on rape pasture; 2 percent, 3 percent and full feed for each third of test respectively

Lot 5 of Experiment VIII, fed corn, 9; tankage, 1, on rape pasture; full feed

Lot 6 of Experiment VIII, fed corn, 9; tankage, 1, on rape pasture; 2 percent, 3 percent and full feed for each third of test respectively

Table XII gives a summary of the results of Experiment VIII in three periods of 6 weeks each. Throughout the test the pigs fed corn alone gained less rapidly than those fed tankage in addition to the corn. The pigs of Lot 1 full-fed corn alone required fewer pounds of concentrates per unit of gain during the second period than they did during the first. This suggests that, when fed corn alone on forage, heavier pigs may be expected to do less poorly than younger pigs. With tankage valued at twice the price of an equal weight of corn the cost of concentrates per unit of gain during the second period was lower for the pigs full-fed corn alone than it was for those fed a ration containing 10 percent of tankage. The latter, however, because of their higher rate of gain, gave a greater return over the value of the feed.

For all three periods the pigs of Lot 2 gained more slowly and required a larger amount of concentrates per unit of gain than those of the two other lots similarly fed except that they received some tankage in the ration.

During the last third of the test, when all the lots were full-fed, those which previously received a limited allowance of concentrates required fewer pounds of concentrates per unit of gain than those that were full-fed throughout the test.

For the first two-thirds of the experiment the amount of feed required to produce 100 pounds of gain was less for the full-fed pigs given 5 percent of tankage than it was for those given 10 percent of tankage in the ration. For the last third of the test the opposite was true. This would seem to indicate that if full-fed pigs are to be carried to a heavy weight 5 percent of tankage in the ration is hardly sufficient.

SOYBEAN PASTURE; FULL AND LIMITED FEEDING

EXPERIMENT IX

Table XIII gives the results of an experiment in which pigs were fed on soybean pasture and given full and limited concentrate rations of corn alone and of corn, 9; tankage, 1. The soybeans were seeded in rows 28 inches apart at the rate of 3 pecks to an acre. The pigs were turned on the beans 11 weeks after they were seeded. Each group was allowed ¼ of an acre. Five pigs were used in the full-fed lots and four in the lots given limited feeds of concentrates.

TABLE XIII.—EXPERIMENT IX: FULL AND LIMITED FEEDING ON SOYBEAN PASTURE

August 9 to October 4, 1912

	Lot 1 Corn alone full feed	Lot 2 Corn alone four-fifths feed	Lot 3 Corn, 9 tankage, 1 full feed	Lot 4 Corn, 9; tankage, 1 four-fifths feed
Pigs per lot..... number..	5	4	5	4
Average initial weight..... pounds..	37.3	38.5	37.1	37.75
Total gain..... pounds..	288.	229	329.5	225
Average daily gain..... pounds..	1.029	1.022	1.177	1 004
Concentrates consumed: corn..... pounds..	804.75	515.25	748.125	478.8
tanakge..... pounds..	.....	.....	83.125	53.2
total..... pounds..	804.75	515.25	831.25	532.
Daily concentrates per pig..... pounds..	2.874	2.300	2.969	2.375
Concentrates daily per 100 pounds weight... pounds..	4.348	3.427	4.238	3.605
Concentrates per 100 pounds gain: corn..... pounds..	279.427	225.000	227.048	212.800
tankage..... pounPs..	.....	.....	25.228	23.644
total..... pounds..	279.427	225.000	252.276	236.444
Cost of concentrates per 100 pounds gain..... dollars..	5.59	4.50	5.55	5.20
Value of pasture utilized..... dollars..	6.00	6.00	6.00	6.00
Value of gains over value of feed and pasture. dollars.. (On basis of 5 pigs per lot)	18.22	19.69	21.84	17.24

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds.

The experiment was continued for only 8 weeks. While the soybean plant is palatable, makes a fairly efficient forage and furnishes green feed during late summer when pastures are likely to be short, as a pasture crop it is subject to the criticism that it does not produce new growth after being pastured and so furnishes forage for only a comparatively short time.

The pigs given full feeds of grain gained more rapidly than those given limited allowances of grain. Of the full-fed pigs those getting tankage gained more rapidly than those getting no tankage. There was very little difference in the rate of gain of the two lots fed limited rations. The light-fed pigs required a smaller amount of concentrates per unit of gain than the full-fed ones, those full-fed corn and tankage a smaller amount than those full-fed corn alone and those fed a limited ration of corn alone a smaller amount than those fed a limited ration containing 10 percent of tankage.

SELF FEEDING ON RAPE PASTURE

EXPERIMENT X

In the experiment reported in Table XIV two lots of pigs were self-fed on rape pasture. One was given corn alone and the other corn and tankage in separate compartments of the feeder. These two were compared with a third lot self-fed corn and tankage separately in dry lot. Shelled corn was used. The rape was seeded in rows 24 inches apart at the rate of 4 pounds to an acre. The experiment began 68 days after the time the rape was seeded. At the beginning of the test the pigs ranged from 97 to 109 days of age.

TABLE XIV.—EXPERIMENT X: SELF FEEDING IN DRY LOT AND ON RAPE PASTURE

June 29 to October 1, 1915.

	Lot 1 Corn alone	Lot 2 Corn and tankage	Lot 3 Corn and tankage dry lot
Number of pigs.....number	8	8	6
Average initial weight.....pounds..	64.8	64.2	64.3
Total gain.....pounds.	716	1,196.5	600
Average daily gain.....pounds..	.952	1.591	1.064
Concentrates consumed: corn.....pounds..	3,058.	4,490.500	2,349.
tankage.....pounds..	.....	136.571	277.
total.....pounds..	3,058.	4,627.071	2,626.
Daily concentrates per pig: corn.....pounds..	4.066	5.971	4.165
tankage.....pounds..	.....	.182	.491
total.....pounds..	4.066	6.153	4.656
Concentrates daily per 100 pounds weight....pounds..	3.712	4.428	4.072
Concentrates per 100 pounds gain: corn.....pounds..	427.095	375.303	391.500
tankage.....pounds..	.....	11.414	46.167
total.....pounds..	427.095	386.717	437.667
Cost of concentrates per 100 pounds gain.....dollars..	8.54	7.96	9.68
Value of pasture utilized.....dollars..	6.00	6.00	.....
Value of gains over value of feed and pasture on basis of 8 pigs per lot .....dollars..	33.08	66.24	34.59
Concentrates replaced by an acre of pasture: corn.....pounds.	-1,019.440	775.190	.....
tankage.....pounds	1,322.213	1,663.253	.....
Corn or its equivalent in cost saved by an acre of pasture.....bushels.	29.018	73.245	.....
Parts corn to tankage consumed.....	.....	32.88:1	8.48:1

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds. On August 31 a pig was taken out of Lot 2, weight 153.5 pounds.

The pigs fed corn and tankage on rape pasture made the most rapid gains and required the fewest pounds of concentrates per unit of gain. Those fed corn alone on rape gained more slowly but consumed fewer pounds of concentrates per unit of gain than the pigs in dry lot. The pigs with no pasture ate 1 pound of tankage to 8.48 pounds of corn. Those on forage ate a much smaller proportion. Tankage in the ration of the pigs on forage resulted in a saving of 9.45 percent of concentrates per unit of gain. The small amount of tankage which the pigs consumed not only resulted in a marked saving of feed but also greatly increased the rate of gain. The replacement value of the rape per acre and the value of the gains over the value of the feed and pasture were more than doubled.

COMPARISON OF SELF AND HAND FEEDING ON RAPE PASTURE

EXPERIMENT XI

Table XV shows the results of Experiment XI, comparing self- and hand-feeding on rape pasture. Purebred Tamworth pigs from 15 to 18 weeks of age were used in the experiment. The rape was seeded May 1 in rows 24 inches apart at the rate of 4 pounds to an acre. Each plot contained an area of ½ acre. Shelled corn was fed. The self-fed pigs were allowed access to both corn and tankage in separate compartments of the feeder. The hand-fed pigs were given a ration of corn, 9 parts; tankage, 1 part.

TABLE XV.—EXPERIMENT XI: COMPARISON OF SELF AND HAND FEEDING ON RAPE PASTURE

August 5 to November 27, 1915

Nine pigs in each lot	Lot 1 Shelled corn, 9; tankage, 1 hand-fed	Lot 2 Shelled corn and tankage. Self-fed separately
Average initial weight....pounds	99	99.833
Total gain....pounds	1,558	1,733
Average daily gain....pounds	1.519	1.689
Concentrates consumed: corn....pounds	6,483.6	6,785
tankage....pounds	720.4	380
total....pounds	7,204.0	7,165
Daily concentrates per pig: corn....pounds	6.319	6.613
tankage....pounds	.702	.370
total....pounds	7.021	6.983
Concentrates daily per 100 pounds weight....pounds	3.784	3.579
Concentrates per 100 pounds gain: corn....pounds	416.149	391.518
tankage....pounds	46.239	21.927
total....pounds	462.388	413.445
Cost of concentrates per 100 pounds gain....dollars	10.17	8.71
Value of pasture utilized....dollars	12.00	12.00
Value of gains over value of feed and pasture....dollars	47.63	79.72
Parts corn to tankage consumed	9:1	17.85:1

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds.

The hand-fed pigs were heavily fed. Although both lots consumed practically the same amount of concentrates daily the hand-fed pigs ate more concentrates daily per unit of weight. This is unusual. The self-fed pigs gained 11.2 percent more rapidly than the hand-fed pigs and consumed 89.4 percent as much concentrates per unit of gain. They ate only about one-half as much tankage as was given the hand-fed pigs. It would appear from the results that the latter were fed a larger proportion of tankage than was needed. The self-fed pigs consumed an average of about one-third of a pound of tankage daily per head, which amounted to 1 pound of tankage for each 17.8 pounds of corn. The proportion of tankage was greater for the first half than it was for the second half of the experiment. For each fourth of the test respectively the pigs consumed an average of 0.52, .42, .30 and .38 pound daily per head.

EXPERIMENT XII

Table XVI shows the results of a second experiment in which self- and hand-feeding on rape pasture were compared. The pigs were from 18 to 20 weeks old at the beginning of the experiment. Two crossbred Duroc-Jersey-Tamworth and four purebred Tamworth pigs were used in each lot. The rape was seeded in rows 24 inches apart at the rate of 3 pounds to an acre 74 days before the beginning of the experiment. Each plot contained ½ acre.

TABLE XVI.—EXPERIMENT XII: COMPARISON OF SELF AND HAND FEEDING ON RAPE PASTURE

July 25 to October 10, 1916			
Six pigs in each lot		Lot 1 Corn and tankage self-fed separately	Lot 2 Corn, 19; tankage, 1 hand-fed
Average initial weight	pounds..	79.167	79.167
Total gain	pounds..	684	492.5
Average daily gain	pounds..	1.481	1.066
Concentrates consumed: corn	pounds..	2,103.5	1,460.150
tankage	pounds..	369.1	76.85
total	pounds..	2,472.6	1,537.00
Daily concentrates per pig: corn	pounds..	4.553	3.161
tankage	pounds.	.799	.166
total	pounds..	5.352	3.327
Concentrates daily per 100 pounds weight	pounds..	3.930	2.768
Concentrates per 100 pounds gain: corn	pounds..	**307.529**	**296.477**
tankage	pounds..	**53.962**	**15.604**
total	pounds..	**361.491**	**312.081**
Cost of concentrates per 100 pounds gain	dollars..	8.31	6.55
Value of pasture utilized	dollars..	12.00	12.00
Value of gains over value of feed and pasture	dollars..	26.93	24.67
Parts corn to tankage consumed		5.70:1	19:1

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds.

The hand-fed pigs took only 70.4 percent as much concentrates daily per unit of weight as did the self-fed pigs. As would be expected from this the hand-fed pigs gained more slowly but required fewer pounds of concentrates for each 100 pounds of gain produced. The self-fed pigs ate an excessive amount of tankage which amounted to 17.5 percent of the total concentrate ration. The hand-fed pigs were given 5 percent of tankage in the ration. This is another instance in which pigs having access to both corn and tankage ate more tankage than was necessary for most economical gains. In feeding operations one should observe whether the pigs are taking too large a proportion of tankage. If they are their consumption of it should be limited in some way.

EXPERIMENT XIII

During the summer of 1917 a third comparison of self- and hand-feeding rations of corn and tankage on rape pasture was made. Both lots consisted of five purebred Tamworth pigs which were from 97 to 105 days of age at the beginning of the experiment. The rape was drilled solid at the rate of 5 pounds to an acre. Each plot contained a quarter of an acre and furnished an abundance of forage throughout the test. The pigs were turned on the plots 74 days after the date of seeding. As in the other two trials the self-fed pigs were given free access to both corn and tankage in separate divisions of the feeder. Shelled corn was fed. The hand-fed pigs were given tankage at the rate of 0.2 pound daily per head. This was fed dry with the corn. Table XVII gives the results secured.

TABLE XVII.—EXPERIMENT XIII: COMPARISON OF SELF AND HAND FEEDING ON RAPE PASTURE

July 16 to November 19, 1917.

Five pigs per lot	Lot 1 Corn and tankage Self fed	Lot 2 Corn and tankage Hand fed
Average initial weight ..... pounds..	68.8	68.8
Total gain ..... pounds..	1,028.5	854.
Average daily gain ..... pounds..	**1.633**	**1.356**
Concentrates consumed: corn ..... pounds..	3,705.9	2,997.
tankage ..... pounds..	429.8	126.
total ..... pounds..	4,135.7	3,123.
Daily concentrates per pig: corn ..... pounds..	5.882	4.757
tankage ..... pounds..	.682	.200
total ..... pounds..	6.564	4.957
Concentrates daily per 100 pounds weight ..... pounds..	3.824	33.215
Concentrates per 100 lbs. gain: corn ..... pounds..	**360.321**	**350.937**
tankage ..... pounds..	**41.789**	**14.754**
total ..... pounds..	**402.110**	**365.691**
Cost of concentrates per 100 pounds gain ..... dollars..	8.88	7.61
Value of pasture utilized ..... dollars..	6.00	6.00
Value of gains over value of feed and pasture ..... dollars..	46.68	48.58
Parts corn to tankage consumed	8.66:1	23.79:1
Yield in dressed weight ..... percent..	82.992	83.005

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 per acre; hogs, $14 per 100 pounds.

Self-feeding resulted in a marked increase in the rate of gain and in the amount of concentrates consumed daily per unit of weight. The hand-fed pigs took only 84.07 percent as large an amount of concentrates daily for each 100 pounds of live weight as did the self-fed pigs. The consumption of tankage by the self-fed pigs was more than three times as great as the amount given in the case of hand feeding. The tankage consumed amounted to 16, 11.1 and 6.1 percent of the total concentrate ration for each third of the test, respectively. The hand-fed pigs required fewer pounds of concentrates for each 100 pounds of gain produced than did the self-fed pigs. Because of this and the smaller amount of tankage given

them, at the prices used, their returns over the cost of feed were greater than those resulting from self-feeding.

A pig 3.4 pounds heavier than the average for the lot was retained from Lot 1. The others were slaughtered and their dressing percentages determined. Although the hand-fed pigs were lighter, the relative yield in dressed weight was practically the same for the two lots. The fasted live weights and the warm dressed weights were used in making the computations.

COMPARISON OF FORAGE CROPS

EXPERIMENT XIV

FIELD PEAS AND OATS; PEAS AND RAPE; RAPE ALONE

Table XVIII gives the results of an experiment in which forage plots of (1) field peas and oats, (2) field peas and rape and (3) rape alone were compared. On May 3 the field peas in both plots were seeded with a drill in rows 8 inches apart. Because of rain the oats and rape were not seeded until 2 days later. The oats were then broadcasted and harrowed in, and the rape drilled in rows 24 inches apart. In the first plot the peas were sown at the rate of 2½ bushels per acre and the oats at the rate of 1½ bushels. This proved to be a heavy seeding. Better pasture would have resulted if 1 to 1½ bushels of peas and 3 to 4 pecks of oats per acre had been used. In the second plot the peas were seeded at the rate of 1 bushel and the rape at the rate of 3 pounds per acre. The rape in the third plot was seeded at the rate of 4 pounds to an acre. The pigs were turned on the forage on June 26 or between 7 and 8 weeks after the time of seeding. Pods were beginning to form on the peas. The oats had not headed out. Each plot contained one-fourth of an acre. Eight pigs from 9 to 11 weeks of age were placed on a plot.

In characteristics the field pea resembles the garden pea. It produces an abundant growth. Since the vines grow to considerable length, are tender and have a tendency to lodge, when they are sown for pasturing some crop that will aid in supporting them should be seeded with the peas. Rape proved better for this purpose than the oats. Because of their extreme succulence trampling on the stems killed the vines.

After 6 weeks of pasturing very few peas remained in the second plot and almost no green feed was left in the first plot. The rape in the second plot having been shaded by the peas at first made only a scanty growth. Later the pigs ate it faster than new growth was produced. While the supply of green feed on the first two plots

was practically exhausted at the end of 6 weeks' time and it was necessary to discontinue the first two lots at that time, the rape plot carrying the same number of pigs similarly fed, furnished pasture throughout the summer. Some pasture was left when the pigs were taken off October 9 after having been on the plot for 15 weeks.

TABLE XVIII.—EXPERIMENT XIV: COMPARISON OF FORAGE CROPS

June 26 to August 7, 1916

Eight pigs in each lot		Lot 1 Corn, 14; tankage, 1	Lot 2 Corn, 14; tankage, 1	Lot 2 Corn, 14; tankage, 1
Kind of forage		Field peas and oats	Field peas and rape	Rape alone
Average initial weight	pounds..	38.75	39.562	39.875
Total gain	pounds..	275.5	*281.5	308.5
Average daily gain	pounds..	.82	.84	.92
Concentrates consumed: corn	pounds..	762.07	758.33	758.33
tankage	pounds..	54.43	54.17	54.17
total	pounds..	816.5	812.5	812.5
Daily concentrates per pig	pounds..	2.430	2.418	2.418
Concentrates daily per 100 pounds weight	pounds..	4.342	4.101	4.088
Concentrates per 100 pounds gain: corn	pounds..	276.613	269.389	245.812
tankage	pounds..	19.757	19.243	17.559
total	pounds..	296.370	288.632	263.371
Cost of concentrates per 100 pounds gain	dollars..	6.32	6.16	5.62
Value of pasture	dollars..	6.00	6.00	6.00
Value of gains over value of feed and pasture	dollars..	15.15	16.08	19.86

*July 3 a pig weighing 27 pounds was replaced with one weighing 56 pounds.

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 an acre; hogs, $14 per 100 pounds.

Experiment XIV, appearance of plots at close of test; left to right, (1) field peas and oats, (2) field peas and rape, (3) rape alone

Not only did the rape alone furnish green feed for a longer time than did the mixtures, but, during the time shown in the table, the pigs on it under similar treatment gained more rapidly and required fewer pounds of concentrates per unit of gain. In both rate and economy of gains those on the mixture of field peas and rape ranked second with the pasture of oats and field peas giving the poorest results of the three.

EXPERIMENT XV

RAPE; OATS AND RAPE; SOYBEANS AND RAPE

In 1917 a comparison of rape alone, rape and oats and rape and soybeans as forage crops for fattening pigs was made. The rape was seeded in all plots at the rate of 5 pounds to an acre and was drilled solid. One bushel of oats and one-half bushel of soybeans were seeded to an acre. The rape grew more rapidly than the beans so that the beans were partially smothered out and produced only a meager growth. The plots were seeded on May 5 and were not pastured until July 16. Since the season was late the oats were not yet ripe but were more nearly mature than is desirable. With the exception of one pig in Lot 2 and one in Lot 3, which were purebred Tamworths and 2 weeks younger, crossbred Duroc-Jerseys-Tamworth pigs 11 weeks of age at the beginning of the test were used. Shelled corn was fed. The pigs were given 0.2 of a pound of tankage daily a head. This was added to the corn and fed dry. Table XIX shows the results secured.

TABLE XIX.—EXPERIMENT XV: COMPARISON OF FORAGE CROPS

July 16 to November 19, 1917.

Five pigs per lot	Lot 1 Corn and tankage	Lot 2 Corn and tankage	Lot 3 Corn and tankage
Kind of forage	Rape	Oats and rape	Rape and soybean
Average initial weight ..... pounds..	45.2	45.1	44.9
Total gain ..... pounds..	864.5	817.5	762.
Average daily gain ..... pounds..	1.372	1.298	1.210
Concentrates consumed: corn ..... pounds..	2,553.	2,446.	2,407.
tankage ..... pounds..	126.	126.	126.
total ..... pounds..	2 679.	2,572.	2,533.
Daily concentrates per pig: corn ..... pounds..	4.052	3.883	3.821
tankage ..... pounds..	.200	.200	.200
total ..... pounds..	4.252	4.083	4.021
Concentrates daily per 100 pounds weight ..... pounds..	3.230	3.218	3.320
Concentrates per 100 pounds gain: corn ..... pounds..	295.315	299.205	315.379
tankage ..... pounds..	14.575	15.413	16.535
total ..... pounds..	309.890	314.618	332.414
Cost of concentrates per 100 pounds gain ..... dollars..	6.49	6.60	6.98
Value of pasture utilized ..... dollars..	6.00	6.00	6.00
Value of gains over value of feed and pasture .. dollars..	58.93	54.49	47.50
Parts corn to tankage consumed	20.3:1	19.4:1	19.1:1

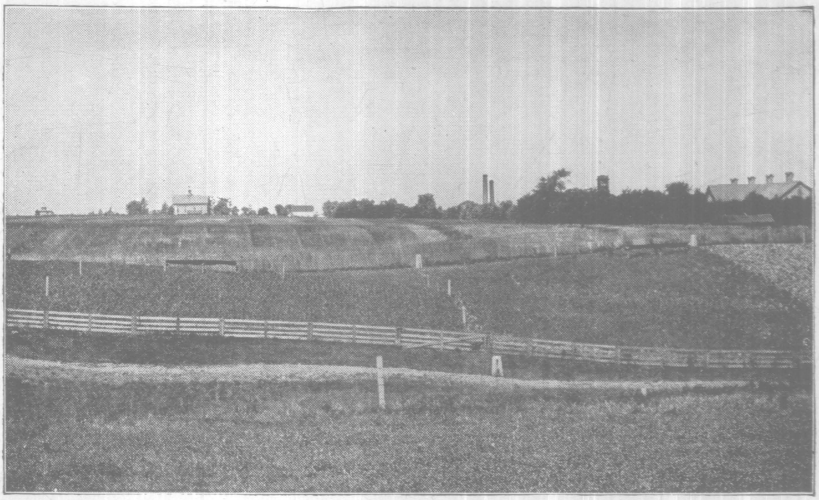
Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 an acre; hogs, $14 per 100 pounds.

All plots supplied sufficient forage throughout the test. As in Experiment XIV the pigs on rape alone made more rapid gains than did those having mixed forage as pasture. They also required a slightly smaller amount of concentrates per unit of gain. The allowance of 0.2 pound of tankage daily amounted to one part of tankage for 19.1 to 20.3 parts of corn consumed or a little less than 5 percent of the total concentrate ration.

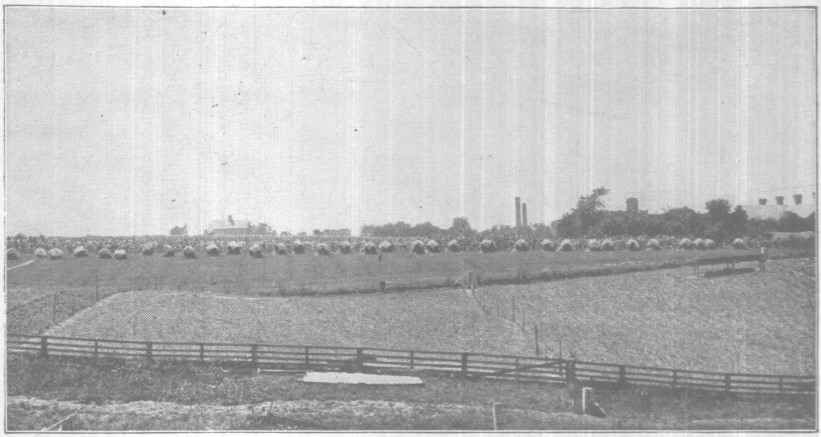
EXPERIMENT XVI

RAPE; RAPE AND OATS; FIELD PEAS AND OATS

In 1914 rape alone was compared with a mixture of rape and oats and another of oats and Canada field peas. The plots were seeded May 18. The oats on both plots were sown at the rate of 1½ bushels an acre and the field peas at the same rate. The rape was drilled solid. On June 30, 43 days after the time of seeding, five fall gilts were placed on each plot. The average initial weights of those on rape, on rape and oats and on oats and field peas were 208.4, 206.6 and 207.6 pounds, respectively. All lots received 2 pounds of corn daily per head. During the first two weeks the average daily gain was 0.88 pound for the gilts on the rape plot, 0.64 for those on the rape and oats plot and 0.42 for those on the plot of oats and field peas. During the third week all of the lots lost in weight. Those on the oats and peas showed a total loss for the week of 19.5 pounds as compared with a loss of 1.5 pounds by each of the other lots. By the end of the third week the mixtures of oats and peas and of oats and rape were so nearly cleaned up that it was necessary to take the gilts out and give them other forage. The rape, though eaten down rather closely, still supplied some green forage so the gilts of this lot were left on the plot another week. From the results of the test, Mr. Eastwood, who was then in charge of the work, concluded a mixture of oats and peas possessed a relatively low value as a forage for swine and that the rape alone was more valuable and produced more forage than a mixture of rape and oats.



Experiment XVI, left to right, (1) oats and field peas, (2) oats and rape, (3) rape alone (only a corner of rape plot showing)...Taken June 30, 43 days after seeding



Experiment XVI, oats and field peas at left, oats and rape at right, plot of rape alone not shown. Taken July 21 after being grazed for 21 days

EXPERIMENT XVII

COMPARISON OF SWEET CLOVER AND SOYBEAN PASTURE

In Experiment XVII a comparison of sweet clover and of soybean pasture as forages for fattening pigs was made. Four lots were used. Rations of corn alone and of corn and tankage were fed on both kinds of pasture. Those of corn and tankage contained 10 percent of tankage the first week. This was decreased one percent each week so that for the last week of the test no tankage was fed. Both the soybeans and sweet clover were seeded on May 5. Thirty pounds of sweet clover seed were sown to an acre. The test began 10½ weeks after the time of seeding.

Sweet clover is a biennial. The second year's growth, however, is coarse and woody and is not recommended for use as a pasture for swine. The white and yellow flowering varieties (Melilotus alba and Melilotus officinalis) are the most common and are the ones most frequently used for forage. The white flowered variety was used in this test. It matures later, is usually taller and produces a more rank growth than does the yellow-flowered variety.

TABLE XX.—EXPERIMENT XVII: COMPARISON OF SWEET CLOVER AND SOYBEAN PASTURE

July 18 to September 26, 1913				
Six pigs in each lot	Lot 1 Corn alone	Lot 2 Corn plus tankage 10 to 0%	Lot 3 Corn alone	Lot 4 Corn plus tankage 10 to 0%
Kind of forage	Sweet clover	Sweet clover	Soybeans	Soybeans
Average initial weight....pounds..	55.167	55.917	55.583	55.250
Total gain....pounds..	418.5	440.5	523.5	520.5
Average daily gain....pounds..	.996	1.049	1.246	1.239
Concentrates consumed: corn....pounds..	1,515.5	1,442.215	1,515.5	442.215
tankage....pounds..	.....	73.285	.....	73.285
total....pounds..	1,515.5	1,515.5	1,515.5	1,515.5
Daily concentrates per pig: corn....pouuds..	3.608	3.434	3.608	3.434
tankage....pounds..	.....	.174	.....	.174
total....pounds..	3.608	3.608	3.608	3.608
Concentrates daily per 100 pounds weight...pounds..	4.007	3.896	3.637	3.659
Concentrates per 100 pounds gain: corn....pounds..	362.127	327.404	289.494	277.082
tankage....pounds..	.....	16.637	.....	14.080
total....pounds..	362.127	344.041	289.494	291.162
Cost of concentrates per 100 pounds gain.... dollars..	7.24	7.21	5.79	6.10
Value of pasture....dollars..	6.00	6.00	6.00	6.00
Value of gains over value of feed and pasture.dollars..	22.28	23.89	36.98	35.09

Corn, $1.12 per bushel; tankage, $80 per ton; pasture, $24 an acre; hogs, $14 per 100 pounds.

The pigs did not find the sweet clover palatable and at first did not eat it but sorted out and ate what little foreign growth could be found such as tufts of meadow-foxtail. Since they were confined to the plots and had access to no other green feed they were forced to eat the sweet clover after a time and became somewhat accus-

tomed to it but never ate it readily. The sweet clover plots would have furnished pasture for a longer time than did the soybean plots which supplied little forage after the experiment was closed.

Both lots on soybean pasture gained more rapidly and required fewer pounds of concentrates per unit of gain than either of those on sweet clover. The pigs on sweet clover fed the ration containing tankage made gains at a higher rate and with a lower concentrate requirement than did those which received only corn. Of the two lots on soybean pasture, however, there was very little difference in either the rate of gain or the concentrates required per unit of gain.

All lots were given a full feed of grain. The fact that the pigs on sweet clover took a larger amount of concentrates daily per unit of weight shows in another way the lower palatability of the sweet clover in comparison with that of the soybeans.

In experiments reported in Bulletin 242 soybean pasture proved less valuable than rape or clover. The results of these experiments would indicate that as a forage crop for swine sweet clover is markedly inferior to either red clover or rape.

RELATIVE AMOUNTS OF CONCENTRATES CONSUMED BY SELF-FED PIGS OF VARIOUS WEIGHTS

Table XXI shows the average amounts of corn and of tankage consumed daily per head by pigs on forage and others in dry lot when they were self-fed the two feeds separately. The proportions of corn and tankage taken are also given. The results shown are those for Experiments I, II, X, XII and XIII. Since no records were kept of the amounts of feed consumed weekly in Experiment XI it could not be included.

TABLE XXI.—AVERAGE AMOUNTS AND PROPORTIONS OF CONCENTRATES CONSUMED BY SELF-FED PIGS

Weight of pigs	Feed daily per pig			Parts corn and tankage
	Corn	Tankage	Total	
On forage				
Under 50 pounds	2.255	.271	2.526	8.3:1
50 to 100 pounds	3.756	.370	4.126	10.1:1
100 to 150 pounds	4.842	.544	5.386	8.9:1
150 to 200 pounds	6.564	.441	7.005	14.9:1
Above 200 pounds	7.520	.391	7.911	19.2:1
Total average	4.862	.431	5.293	11.3:1
Dry lot				
Under 50 pounds	2.371	.405	2.776	5.9:1
50 to 100 pounds	3.743	.436	4.179	8.6:1
100 to 150 pounds	5.360	.594	5.954	9.0:1
150 to 200 pounds	6.342	.348	6.690	18.2:1
Total average	4.761	.484	5.245	9.8:1

Both in the dry lot feeding and in the feeding on forage a larger amount of tankage daily per head was consumed by the pigs while they were between 100 and 150 pounds in weight than was consumed during any of the other periods. The daily consumption of tankage gradually increased up to and including this period then decreased as the pigs became heavier. The average daily consumption of tankage by the pigs on forage and those in dry lot until a weight of 200 pounds was reached was 0.43 and 0.48 pound, respectively. With one exception the proportion of tankage to corn decreased as the pigs increased in weight. The pigs fed in dry lot took a larger proportion of tankage than those on pasture, especially during the early part of the experiments.

In some instances the pigs apparently would have done equally as well had a smaller amount of tankage been allowed them. In accordance with their weight hand-fed pigs consume relatively fewer pounds of concentrates daily than do self-fed pigs. If pigs are on forage an allowance of a quarter of a pound of tankage daily per head until a weight of 100 to 125 pounds is reached and 0.3 pound thereafter until marketed should give good results and prove economical. In dry lot feeding 0.3 pound daily to pigs under 100 pounds in weight and 0.4 pound to pigs above this weight will be not far wrong at any time. The tankage may be fed dry or as a thin slop. The ease of this method of determining the amount of tankage to feed will probably appeal to those who feed ear corn.

REPLACEMENT VALUE OF TANKAGE

In dry lot.—Table XXII shows the average of results secured from feeding rations of corn and tankage in 32 experiments to a total of 200 pigs confined in dry lots and fed in 36 different groups and also shows the results from feeding rations of corn alone to pigs compared with those in some of the above experiments. The corn and tankage rations consisted of an average of 9.7 parts of corn to 1 part of tankage. The pigs fed corn alone gained only 57.4 percent as rapidly as those fed corn and tankage. When corn was fed alone 9.61 bushels were required for each 100 pounds of gain produced. With tankage in the ration only 7.16 bushels of corn were required. A saving of 2.45 bushels of corn resulted from feeding 37.6 pounds of tankage.

Since in a part of the experiments no lots were given corn alone the results may not be considered comparable. The average initial weights did not differ greatly but the experiments in which corn alone was fed averaged only 78 days in length as compared with 94 days for those in which corn and tankage were fed.

In eight experiments in which rations both of corn and tankage and of corn alone were fed relatively similar results were secured. The initial weight per pig of the lots given corn and tankage and of those given corn alone were 87.3 and 86.4 pounds, respectively. The tests ranged from 8 to 15 weeks in length and lasted an average of 78.6 days. The rations of corn and tankage contained an average of 1 pound of tankage to 8.7 pounds of corn. Corn alone produced gains only 52.5 percent as rapidly as corn and tankage. The pigs that received corn and tankage required 345.1 pounds of corn and 39.8 pounds of tankage and those that received corn alone 533.4 pounds of feed for each 100 pounds of gain produced. Each pound of tankage replaced 4.7 pounds of corn.

TABLE XXII.—CORN REPLACED BY TANKAGE IN DRY LOT FEEDING

	Corn and tankage	Corn alone
Number of pigs.....number..	200	32
Average initial weight.....pounds..	75.4	77.5
Total gain.....pounds..	22,086.7	1,730.
Average daily gain.....pounds..	1.211	.695
Feed: corn.....pounds..	80,269.165	93,143.
tankage.....pounds..	8,312.902	.....
total.....ponnds..	88,582.067	93,143.
Feed per 100 pounds gain: corn.....pounds.	363.362	538.399
tankage.....pounds..	37.638	.....
total.....pounds..	401.020	538.399
Corn replaced by 1 pound of tankage.....pounds..	4.650	

On forage.—When fed with corn to pigs on forage tankage does not replace so large an amount of corn as it does in dry lot feeding. Some nitrogenous concentrate, however, is needed with corn by pigs on forage even when a limited grain ration is used.

Table XXIII is presented to show the amount of corn that is replaced by tankage when the pigs are allowed various kinds of pasture. With the exception of two experiments in which corn alone and two in which corn and tankage were fed on bluegrass only experiments that directly compared rations of corn alone and of corn and tankage were included in the summary. Self-fed pigs and the hand-fed ones that ate 3.8 pounds or more of concentrates daily per 100 pounds of live weight were considered as having received a full feed of concentrates.

Bluegrass was less efficient and clover more efficient in reducing the replacement value of the tankage than were the other forages. For rape, soybeans and sweet clover pasture the difference was less than 2 percent. The replacement value of the tankage was lower in the case of the limited feeding than it was in the case of the full feeding. This supports the view that for feeding on forage a smaller proportion of tankage to corn is needed when the grain ration is limited than when a full feed is given.

TABLE XXIII.—CORN REPLACED BY TANKAGE WHEN FED TO PIGS ON FORAGE

	Full Feeding (Self and Hand Fed)										Limited feeding	
	Clover		Rape		Bluegrass		Soybeans		Sweet clover		Rape	
	Corn and tankage	Corn alone	Corn and tankage	Corn alone	Corn and tankage	Corn alone	Corn and tankage	Corn alone	Corn and tankage	Corn alone	Corn and tankage	Corn alone
Parts corn to tankage	14.6:1		14.4:1		10.2:1		9:1		19.7:1		9.7:1	
Number of lots..number	3	2	5	4	3	3	1	1	1	1	4	3
Total number of pigs..number	20	15	42	30	18	11	5	5	6	6	24	20
Average initial weight..pounds	38.6	37.5	47.5	52	108.8	116.7	37.1	37.3	55.9	55.2	41.9	42.7
Total gain..pounds	3,470 25	1,741.833	5,677.	3,062.429	1,598	963.5	329.5	288.	440.5	418.5	1,882.5	1,526.2
Average daily gain..pounds	1.377	.922	1.260	1.012	1.680	1.398	1.177	1.029	1.049	.996	.846	.801
Concentrates: corn..pounds	12,228.456	6,983.778	19,492 358	12,059.043	5,720.936	4,262.	748.125	804.75	1,452.215	1,515.5	4,767.290	4,577.74
tankage..pounds	837.019		1,351.688		562.897		83.125		73.285		490.610	
total..pounds	13,065.475	6,983.778	20,844.046	12,059.043	6,283.833	4,262.	831.250	804.75	1,515.5	1,515.5	5,257.90	4,577.74
Concentrates daily per 100 lbs. weight:												
corn..pounds	3.870	3.867	3.724	3.881	3.926	3.854	3.814	4.348	3.708	4.007	2.640	3.033
tankage..pounds	.265		.258		.386		.424		.188		.272	
total..pounds	4.135	3.867	3,982	3.881	4.312	3.854	4.234	4.348	3.896	4.007	2.912	3.033
Concentrates per 100 lbs. gain: corn..pounds	352.380	400.944	343.357	393.774	358.006	442.346	227.048	279.427	327.404	362.127	253.242	299.944
tankage..pounds	24.120		23.710		35.225		25.228		16.637		26.062	
total..pounds	376.450	400.944	367.167	393.774	393.231	442.346	252 276	279.427	344.041	362.127	279.304	299.944
Corn replaced by 1 pound of tankage..pounds	**2.013**		**2.117**		**2.394**		**2 076**		**2.087**		**1.792**	

SUMMARY OF VARIOUS METHODS OF FEEDING

Table XXIV gives a summary showing the average results secured from the various methods of feeding rations of corn and tankage and of corn alone on clover and rape pasture. The few lots included in some instances and larger number in others; the different years in which the tests were conducted; the differences in the initial weights of the pigs; the period and the extent of the growing season utilized as affected by the dates on which the tests were begun and the varying lengths of the experiments and other factors involved no doubt affect the averages to some extent but are not likely to obscure any marked differences or alter the relationships when the variations are large.

In determining the gains attributable to an acre of pasture the average corn equivalents of the tankage as shown in Table XXIII were used. Since no experiments were conducted which show the replacement value of tankage in limited feeding on clover that for limited feeding on rape was used in all cases in which the feed averaged less than 3.5 pounds daily for each 100 pounds of live weight. The self-fed pigs that were on forage were compared with pigs self-fed corn and tankage in dry lot. With both full and limited feeding the pigs on forage that were hand-fed were compared with hand-fed pigs receiving a full feed of corn and tankage in dry lot. Since in the experiments in which pigs were self-fed on clover those in dry lot with which they were compared required less feed per unit of gain than any of the average amounts required in dry lot hand feeding, the replacement value was lower and fewer pounds of gain were attributable to an acre of forage than would be the case if self-feeding on clover was compared with hand-feeding in dry lot. Just the opposite is true of the pigs self-fed on rape.

In no case was the average daily gain as great or the amount of concentrates required per unit of gain as low when corn alone was fed as when a similar amount of a ration containing tankage was used. The rate of gain was directly proportional to the allowance of concentrates daily for each 100 pounds of live weight. On both clover and rape when tankage was used a limited ration followed by a full feed for the last part of the test resulted in a greater saving of feed by each acre of pasture than any other method of feeding.

TABLE XXIV.—SUMMARY OF FEEDING EXPERIMENTS ON CLOVER AND RAPE PASTURE

	Average initial weight	Average daily gain	Concentrates per 100 pounds gain			Pounds of gain per bushel of corn or its equivalent in cost*	Concentrates replaced by an acre of pasture		Bushels of corn or its equivalent in cost saved by an acre of pasture	Gains accredited to an acre
			Corn	Tankage	Total		Corn	Tankage		
Clover Pasture										
Corn and tankage self-fed	38 6	1.38	352.4	24.1	376.5	13.98	295.6	154.1	10.8	145.3
Corn and tankage full-fed	39.4	1.22	329.7	18.5	348.2	15.28	784.4	620.0	36.1	473.9
Corn and tankage limited feed followed by full feed	34.5	1.14	314.3	16.5	330.8	16.12	846.4	620.2	37.3	497.9
Corn and tankage 3 percent feed	38 9	.91	315.4	17.3	332.7	16.00	852.4	445.5	31.1	392.5
Corn and tankage 2 percent feed	48.3	.50	250.7	16.1	266.8	19.79	814.9	133.2	19.3	241.9
Corn alone self-fed	37.5	.92	400.9	.....	400.9	13.97	-1,216.3	701.1	3.3	47.7
Rape Pasture										
Corn and tankage self-fed	79.4	1.62	368.1	28.3	396.4	13.18	725.7	551.7	32.7	387.1
Corn and tankage full-fed	54.3	1.24	352.2	27.4	379.6	13.76	1,286.9	277.8	32.9	393.6
Corn and tankage limited feed followed by full feed	39.9	1.03	287.5	21.6	309.1	16.94	2,270.6	306.1	51.5	609.4
Corn and tankage 3 percent feed	44.5	.91	279.0	25.8	304.8	16.94	1,588.5	127.0	32.9	445.0
Corn alone self-fed	64.8	.95	427.1		427.1	13.11	-1,019.4	1322.2	29.0	363.8
Corn alone full-fed	35.3	.88	422.8		422.8	13.25	-355.1	902.8	25.9	340.5
Corn alone limited feed followed by full feed†	34.7	.63	365.7		365.7	15.32	375.3	428.5	22.0	235.3
Corn alone 3.3 percent feed	51.0	.88	329.2		329.2	17.01	-258.7	786.4	23.5	268.0

*Includes only the concentrates with tankage valued at twice the price of corn.
†Average 3 percent feed

SUMMARY OF RESULTS BY EXPERIMENTS

Experiment I.—Young pigs on clover pasture gained more rapidly and required fewer pounds of concentrates per unit of gain when given tankage in addition to corn.

Because of their larger tankage consumption pigs self-fed corn and tankage separately made more costly gains than those hand-fed a corn and tankage ration containing 5 percent of tankage.

There was very little difference in the rate of gain or the concentrate requirement per unit of gain of the pigs self-fed in dry lot and of those self-fed on clover pasture.

The pigs fed limited rations of concentrates gained more slowly but required fewer pounds of concentrates per unit of gain than the full-fed pigs. Full feeding increased the carrying capacity of the clover. The replacement value of the pasture was higher when a 3 percent ration followed by a full feed was fed than when either a full feed or a 3 percent ration for the entire time was given.

Pigs self-fed corn and tankage separately consumed a smaller proportion of tankage as they became heavier. Those on forage ate a smaller proportion of tankage than those in dry lot.

Experiment II.—Self-fed pigs on clover pasture allowed tankage in addition to corn gained more rapidly and required slightly less feed per unit of gain than those self-fed corn alone.

Unlike the results in Experiment I the lot self-fed corn and tankage separately consumed a smaller proportion of tankage than the one given a ration containing 5 percent of tankage.

The pigs self-fed corn and tankage without access to green feed gained slightly more rapidly but required a little more feed per unit of gain than those similarly fed on clover.

The percentage of tankage in the rations of pigs given access to corn and tankage separately in self-feeders decreased as the pigs became heavier. Those in dry lot consumed a larger proportion of tankage than those on clover pasture.

Experiment III.—Full-fed pigs on clover pasture gained more rapidly and required less feed per unit of gain than pigs similarly fed in dry lot. The rate of gain and the amount of concentrates required per unit of gain by pigs on clover varied directly with the amount of concentrates fed.

Experiment IV.—Pigs on rape pasture allowed 3.6 pounds of concentrates daily per 100 pounds of live weight gained 90.5 percent as rapidly and required 88 percent as much concentrates per unit of gain as pigs in dry lot full-fed the same ration, consisting of 9 parts of corn to 1 of tankage.

A limited ration of corn alone on rape pasture resulted in a lower rate of gain, a higher feed requirement and a lower replacement value of the forage than did a limited ration of corn and tankage.

Experiment V.—With tankage at twice the price of an equal weight of corn, when a ration of corn, 14 parts; tankage, 1 part was fed, pigs on rape pasture given a full feed of concentrates were not as profitable as those which were first given a limited ration and later a full feed. The former gained 14 percent more rapidly but required 12 percent more concentrates per unit of gain.

Experiment VI.—Pigs fed a daily ration equal to 3 percent of their weight throughout the test gained 10.86 percent less rapidly than others fed approximately the same average amount of feed daily per unit of weight but given less at first and a full feed for the last third of the test. The former consumed only 1.74 percent less concentrates per unit of gain.

Experiment VII.—Pigs on rape pasture gained more rapidly and required slightly less feed per pound of gain than those similarly fed in dry lot. In feeding on forage the rate of gain, the concentrate requirement per unit of gain, and the yield of dressed carcass varied directly with the amount of concentrates fed.

At the prices used, because of their higher dressing percentage the returns above the cost of feed and pasture for the pigs full fed throughout the experiment were higher than were those for the pigs first given a limited ration and then a full feed.

For the last third of the test the full-fed pigs that previously received a limited ration gained more rapidly and required fewer pounds of concentrates per unit of gain than those that were given a full feed throughout the test.

Experiment VIII.—For full feeding on rape pasture a ration containing 5 percent of tankage proved more economical than one containing 10 percent or one of corn alone. It was also found advisable to feed some tankage with corn when limited feeding was practiced.

With the exception of the ration containing 10 percent of tankage, at the prices used, the returns above the cost of feed and pasture for the pigs full-fed throughout the experiment were greater than for those fed similar rations but given a 2 percent feed, a 3 percent feed and a full feed for each third of the experiment, respectively.

The dressing percentages of the pigs fed limited rations for a part of the time were not so high as were those of the pigs full fed for the entire time.

During the last third of the test when they were all full-fed, the pigs that were previously fed limited rations required fewer pounds of concentrates per unit of gain and with one exception gained more rapidly than those that were full-fed throughout the experiment.

Experiment IX.—The rate of gain and the concentrate requirement per unit of gain of pigs on soybean pasture varied with the amount of concentrates fed. Full-fed pigs given a high-protein supplement gained more rapidly and ate fewer pounds of concentrates for each pound of gain produced than others given only corn as a concentrate. In the case of limited feeding the use of tankage did not increase the rate of gain nor lower the concentrate requirement per unit of gain.

Experiment X.—Pigs self-fed corn and tankage separately on rape pasture made more rapid and more economical gains than others similarly fed in dry lot or others on rape pasture allowed only corn. The percentage of tankage in the ration consumed by the pigs on forage was 2.94 and that consumed by those in dry lot 10.55 of the total ration.

Experiment XI.—Self-feeding corn and tankage separately on rape pasture resulted in a higher rate of gain and a lower feed requirement per unit of gain than did hand-feeding a ration containing 10 percent of tankage. The self-fed pigs ate an average of 0.37 pound of tankage daily, or only about half as much as was given the hand-fed pigs.

Experiment XII.—Hand-feeding a ration of corn and tankage on rape pasture produced gains more slowly but with a lower feed requirement per unit of gain than did self-feeding. In this experiment the self-fed pigs ate an excessive amount of tankage, taking 1 pound of it to 5.7 pounds of corn. The hand-fed lot was given 1 part of tankage to 19 parts of corn.

Experiment XIII.—As in Experiment XII, self-fed pigs gained more rapidly but consumed a larger amount of concentrates for each 100 pounds of gain produced and ate a larger proportion of tankage than the pigs hand-fed in comparison.

Experiment XIV.—Rape alone furnished pasture for a longer time than did a mixture of rape and Canada field peas or one of Canada field peas and oats. During the time that the mixtures supplied grazing, the pigs on the rape, those on the field peas and rape, and those on the field peas and oats ranked in the order named in both rate and economy of gains.

Experiment XV.—Pigs on pasture of rape alone gained more rapidly and required less feed per unit of gain than others on a mixture of rape and oats or a third lot on a mixture of rape and soybeans.

Experiment XVI.—Rape alone produced more forage than a mixture of rape and oats or a mixture of oats and Canada field peas. Three lots of fall gilts fed the same amounts of corn and pastured on these forages gained respectively in the order in which the crops are named.

Experiment XVII.—Sweet clover pasture was distasteful to the pigs. They ate none at first and though they ate some after a time they never learned to eat it readily.

Two lots of pigs fed corn alone and corn and tankage on soybean pasture gained more rapidly and required fewer pounds of concentrates per unit of gain than either of two lots similarly fed on sweet clover pasture.

A small amount of tankage with corn proved beneficial for feeding pigs on sweet clover pasture but was not needed by the pigs on soybean pasture.

Sweet clover furnished green feed for a longer time than did the soybeans.

CONCLUSIONS

Pigs on forage need a smaller amount of nitrogenous concentrates in the ration, require fewer pounds of concentrates per unit of gain and with few exceptions gain more rapidly than do those with no green feed.

With the various methods of feeding and as compared with hand feeding in dry lot the average replacement value of an acre of forage when corn and tankage were fed ranged from 19.3 to 51.5 bushels of corn or its equivalent in cost. Depending on the method of feeding and the amounts of corn and tankage fed, estimated averages of from 242 to 609 pounds of gain per acre were attributable to the forage.

Clover and rape are excellent forage crops. Bluegrass while green makes good pasture. Soybean pasture is an acceptable forage but furnishes pasture for only a relatively short time. Pastures of oats and Canada field peas or of mixtures of rape with Canada field peas, oats or soybeans were not so valuable as rape alone. Sweet clover supplies an abundance of green feed but because it is not palatable has a comparatively low value as a forage for swine.

Through the use of rye and bluegrass in the late fall and early spring and of clover and rape during late spring, summer and fall it is possible to supply pigs with an abundance of excellent forage throughout the growing season.

Full-fed pigs gained at a higher rate and on a lower feed requirement when some tankage was fed than when corn alone was used. Except for pigs on soybean pasture the same was true in limited feeding. With corn or similar carbonaceous feeds from 5 to 8 percent of tankage or its equivalent in some other nitrogenous concentrate is beneficial in the ration. Heavy pigs need a smaller proportion of high protein feed than do lighter ones. If ear corn is fed to pigs on forage allowances of 0.25 pound of tankage daily per head for full-fed pigs under 100 pounds in weight, 0.3 pound for heavier pigs that are full fed, 0.2 pound for pigs weighing less than 100 pounds fed a limited amount of concentrates and 0.25 pound for heavier pigs on a limited feed are suggested.

The rate of gain and the feed required per unit of gain vary with the amount of concentrates fed. Limiting the ration to less than an average of 3 pounds daily for each 100 pounds of live weight is not as economical as feeding 3 pounds or more. If a limited ration is fed a smaller amount should be given at first and a full grain feed allowed during the last part of the feeding period. With cheap pasture and high priced concentrates larger returns over the cost of feed and pasture may sometimes be secured from such a system of feeding than from full feeding for the entire time.

With few exceptions pigs self-fed corn and tankage on forage gained more rapidly but required a larger amount of concentrates per unit of gain than those hand-fed in comparison. When corn and tankage are self-fed separately pigs do not always take the feeds in the proportions that will result in the most economical gains.